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April 3, 1961

Aviation Week

and Space Technology

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Scout Enters New Phase In Development

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Cessna Skymaster

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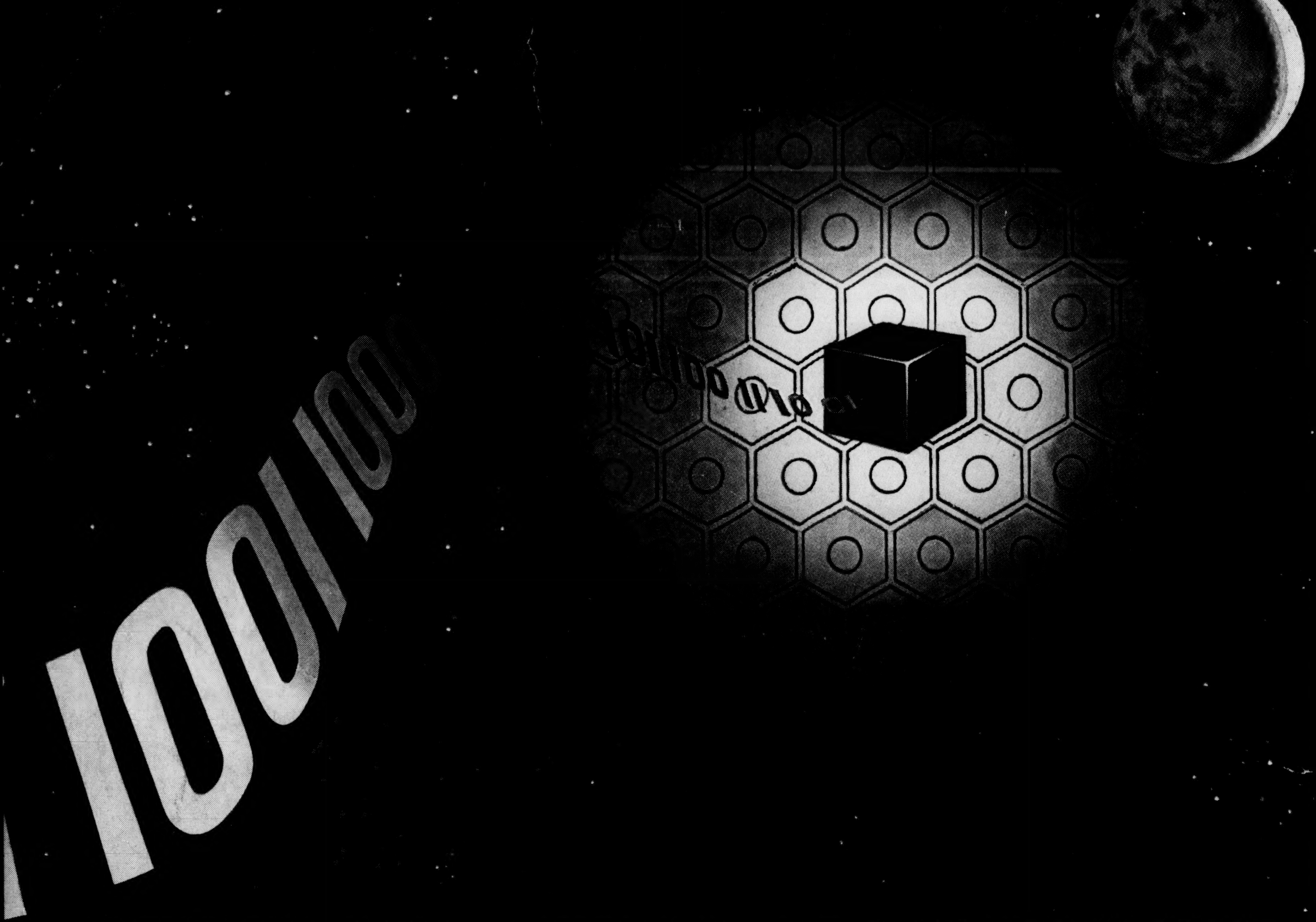

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ASTRO's research investigations involve miniature diode valves which operate without moving parts. When assembled in computer configurations they can carry out all the numerical computations currently performed by their electronic counterparts. The pneumatic digital computer shows promise of providing small volume, light weight, and low cost systems capable of precision control of sophisticated space vehicles and advanced propulsion systems.

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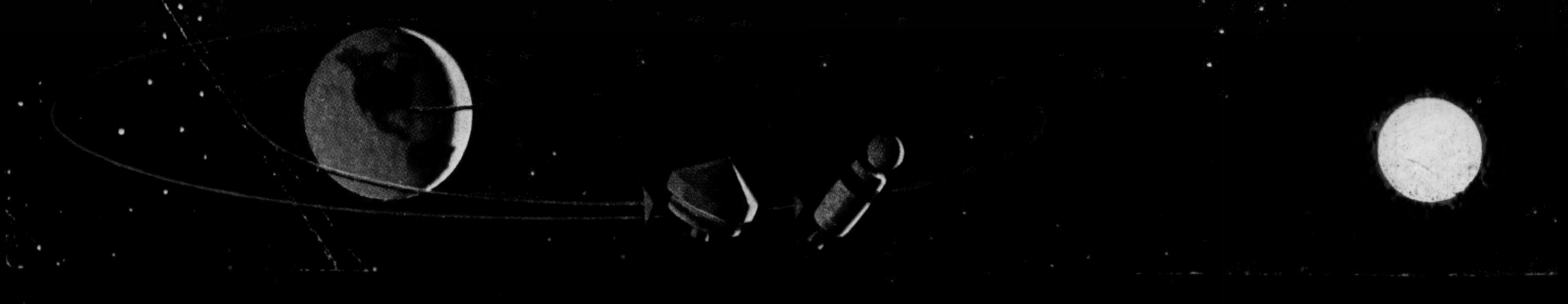

AVIATION CALENDAR

Apr. 10-11—Spring Meeting, Western States Section/The Combustion Institute, Aeronutronic Division of Ford Motor Co., Newport Beach, Calif.

Apr. 10-14—International Symposium on Aviation Research and Development, Federal Aviation Agency, Atlantic City.

Apr. 11-13—Conference on the Ultrapurification of Semiconductor Materials, Air Force Cambridge Research Laboratories, Boston, Mass.

Apr. 12-13—15th Annual Spring Technical Conference, Institute of Radio Engineers/American Rocket Society, Hotel Alms, Cincinnati, Ohio.

Apr. 13-14—Annual Meeting, National Aeronautical Services Assn., Hotel Washington, Washington, D. C.

Apr. 13-14—Institute of the Aerospace Sciences/Army Aviation Meeting (classified), Washington, D. C.

Apr. 17-28—14th Technical Conference, International Air Transport Assn., Queen Elizabeth Hotel, Montreal, Canada.

Apr. 18-20—Symposium on Chemical Reactions in the Lower and Upper Atmosphere, Stanford Research Institute, Mark Hopkins Hotel, San Francisco, Calif.

Apr. 20—Eastern Regional Meeting, Institute of Navigation, Shoreham Hotel, Washington, D. C.

Apr. 20-22—General Meeting, American Meteorological Society with the American Geophysical Union, Washington, D. C.

Apr. 22-25—Annual Meeting and Conference, American Assn. of Airport Executives, Broadmoor Hotel, Colorado Springs.

Apr. 24-27—32nd Meeting, Aerospace Medical Assn., Palmer House, Chicago.

(Continued on page 6)

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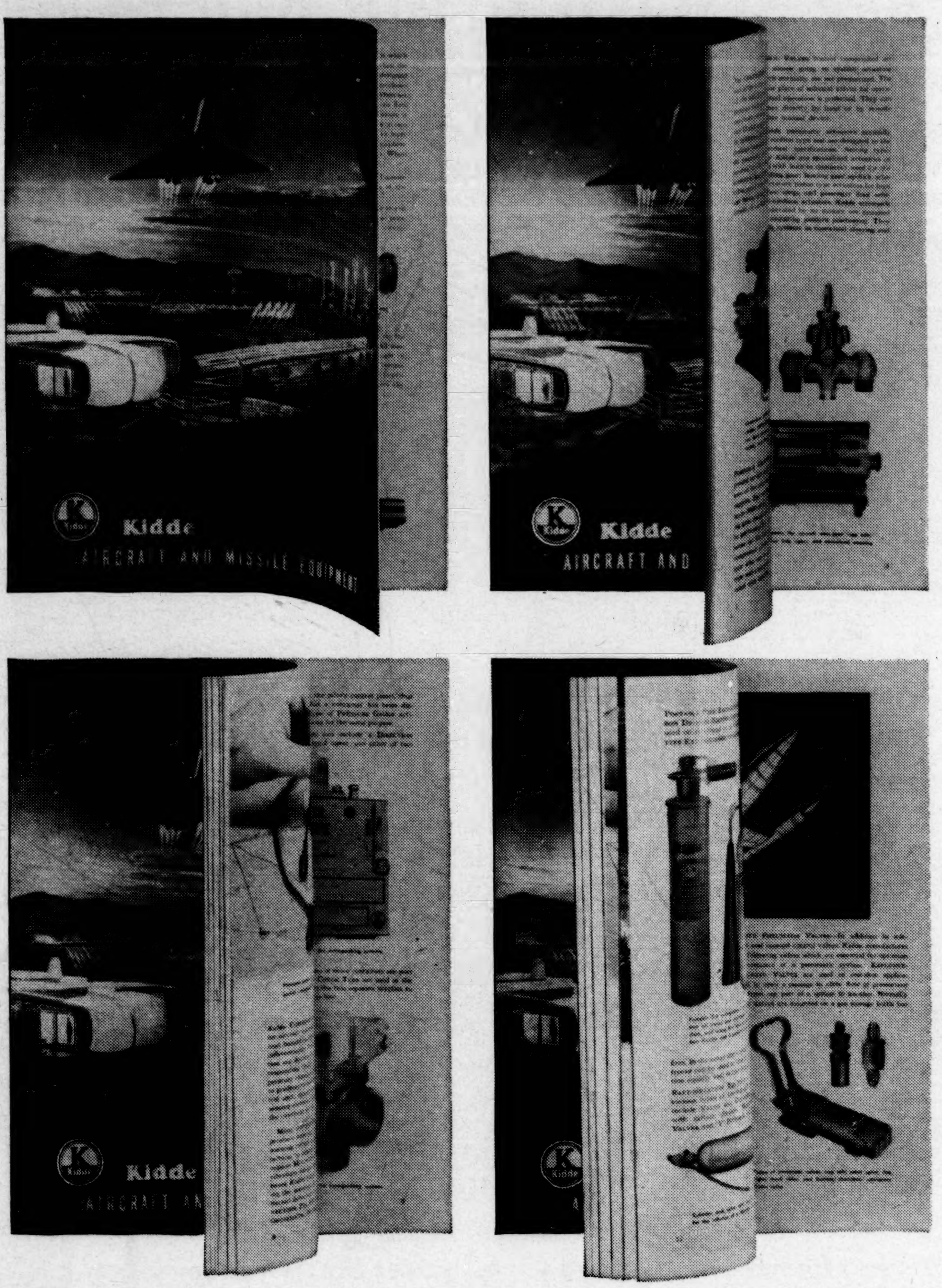

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AVIATION CALENDAR

(Continued from page 5)

Apr. 26—Session on Air Transport Problems, Society of Automotive Engineers' Pacific Northwest Section, New Washington Hotel, Seattle, Wash.

Apr. 26-27—High Temperature Materials Conference, American Institute of Mining, Metallurgical and Petroleum Engineers, Pick-Carter Hotel, Cleveland, Ohio.

Apr. 26-28—Liquid Rockets, Propellants and Combustion Conference, American Rocket Society, Palm Beach, Fla.

Apr. 26-28—Seventh Region Technical Conference, Institute of Radio Engineers, Hotel Westward Ho, Phoenix, Ariz.

Apr. 27-29—13th Annual Air Meet, National Intercollegiate Flying Assn., Texas A&M College, College Station, Tex.

Apr. 30-May 4—Seventh National Aerospace Instrumentation Symposium, Instrument Society of America, Adolphus Hotel, Houston, Tex.

May 2-4—Electronic Components Conference, Institute of Radio Engineers, Jack Tarr Hotel, San Francisco, Calif.

May 3-5—17th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D. C.

May 3-5—Nuclear Applications in Space Conference, American Rocket Society/Oak Ridge National Laboratory, Gatlinburg, Tenn.

May 8-10—National Aerospace Electronics Conference, IRE, Miami and Biltmore Hotels, Dayton, Ohio.

May 8-12—Annual Meeting, Airport Operators Council, Carillon Hotel, Miami Beach, Fla. (AOC-American Society of Civil Engineers' Joint Seminar, "Increased Capacity of Airport Systems," May 11-12.)

May 9-11—Western Joint Computer Conference and Exhibit, Ambassador Hotel, Los Angeles, Calif.

May 11—Air Force Office of Scientific Research Lecture and Banquet in honor of the 80th Anniversary of Theodore von Karman, Sheraton Park Hotel, Washington, D. C.

May 12—National Armed Forces Day Dinner, Sheraton Park Hotel, Washington, D. C.

May 15-16—Region One Air Traffic Control Assn. Convention, Hotel Bradford, Boston, Mass.

May 15-16—Aviation Fire Safety Seminar and Technical Session, National Fire Protection Assn., Hilton Statler Hotel, Detroit, Mich.

May 15-17—National Symposium on Microwave Theory and Techniques, IRE, Sheraton Park Hotel, Washington, D. C.

May 15-18—20th Annual National Conference, Society of Aeronautical Weight Engineers, Sheraton Hotel, Akron, Ohio.

May 22-24—National Telemetering Conference, Sheraton-Towers Hotel, Chicago, Ill.

May 22-24—Fifth National Symposium on Global Communications, Institute of Radio Engineers, Hotel Sherman, Chicago.

May 26-June 4—24th French International Air Show, Le Bourget, Paris, France.

July 25-Aug. 10—International Trade Fair and Aviation Exhibition, McCormick Place Exposition Center, Chicago, Ill.

Sept. 4-10—1961 Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, England.

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COVER: Prototype Cessna Skymaster four-place "light-light twin" business plane is shown in first color photo taken during start of flight test program at the company's Wichita, Kan., plant. Fore-and-aft mounting of Continental engines is designed to avoid yawing characteristic of conventional twin-engine configurations following a powerplant failure and is also aimed at easing transition of former single-engine aircraft owners to multi-engine operation. Some clean-up of initial prototype configuration is expected in detail during the course of flight program in the area of the forward nose section. Airplane's design growth contemplates possibility of using light turboprop powerplants when available.

PICTURE CREDITS

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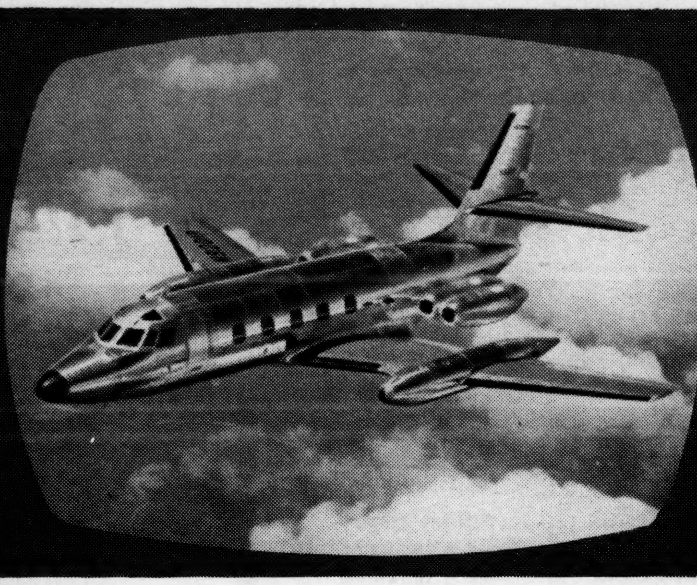
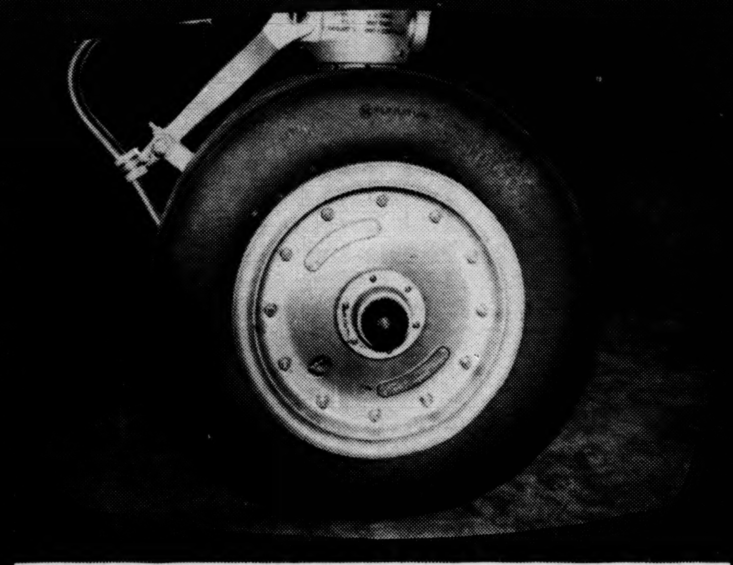


BFG De-Icing system protects wing and tail



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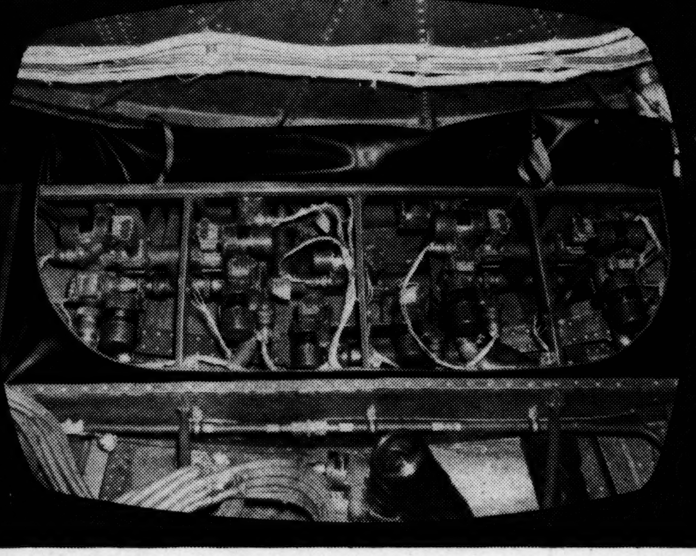

BFG fume panel with pressure sealing zipper gives easy access

B.F.Goodrich helps make the JetStar a small-field, all-weather performer

All-weather capability of the new Lockheed JetStar gets an assist from proven BFG pneumatic De-Icers, which equip the leading edges of wing and tail surfaces. The BFG system was chosen for its light weight and simplicity. An electronic timer activates the solenoid in the distributor valve which then pulsates the De-Icer with turbine bleed air.

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EDITORIAL

The First Decisions

President Kennedy's defense budget message (see p. 26) provides a clear blueprint of the first round of decisions taken by the new Administration in the Pentagon and some sharp portents of its future policy in reshaping the military establishment. The most important aspect of this message is not the nearly $2-billion increase in major weapon system development programed or the relatively minor cutbacks recommended. It lies in the simple fact that the message contains basic decisions made on the basis of necessarily swift but nevertheless thorough analysis of what had become an increasingly shapeless and directionless situation where major decisions were made by drift and indecision rather than positive, calculated action.

The application of decision and positive direction to the military program should be welcomed not only by the defense industry but by every American citizen who pays taxes and expects an adequate defense of his nation and principles. Any group of executives, whether they be in government or private business, who make decisions and chart a forward course will inevitably generate a normal percentage of bad decisions and bloopers. They will also inevitably incur the wrath of those whose pet projects are rejected and whose economic toes are pinched.

Major significance of this budget message is the action to put 220 more ICBMs in operational launch sites by the end of 1964 than had been previously programed. This indicates, better than any quibbling over semantics, that a missile gap of major significance was developing and that firm positive action can still be taken to reduce its perils. When an increase of this magnitude in our deterrent power is possible through more vigorous program stimulation, it becomes crystal clear that despite earlier protestations that all possible energy was being addressed to this problem, this was not the case, and the opportunity for more effective action only awaited executive direction of sufficient vigor backed by fund increases.

The increase in the Minuteman and Polaris programs, plus continuation of the air-launched Skybolt, will concentrate the entire U.S. deterrent force on the successful operation of ballistic missiles in the critical period from 1963 onward. Never in the entire history of this nation has its future ever depended so heavily on a single basic type of weapon. Despite the dispersal of its launching pads in hardened land sites, underseas and in the air, the ballistic missile will become the sole source of Soviet concern for the next decade. This will place an unprecedented premium on the development of an effective ballistic missile defense system. For success in this defensive area would make it possible to achieve a military checkmate in a single technical move.

Admittedly, the ballistic missile defense problem looms as formidable. The doubts of U. S. scientists on an early solution in this country are reflected in the decision to postpone production of the Nike Zeus system and the somewhat thin funding of longer range anti-ICBM studies. Based on our own progress, or lack of it in this field, the current U. S. defense policy is gambling on a similar deficiency in the Soviet defense system for at least another decade. This gamble may be based on what look now to be excellent odds, but it is nevertheless a gamble. As such, it could fail with disastrous results.

It appears that considerably more effort should be spent developing some additional new types of delivery systems for multi-megaton warheads during this period, if for no other reason than the fact that the Soviets will be permitted to concentrate their technical resources on the decisive possibilities of a missile defense system if we lack any other delivery methods. We are not inclined to get too excited about the scaling down of the B-70 bomber program, as proposed in the Kennedy defense budget. Time, compounded by prior indecision, is beginning to catch up with this once promising technical step forward. The slippage of its first possible operational date to the late 1960s dilutes much of its original attractiveness as an alternate delivery system to ICBMs.

We are inclined to shed a larger tear for the wiping out of the aircraft nuclear propulsion program as a far too early abandonment of what is still a revolutionary and promising line of development for a whole family of airborne vehicles.

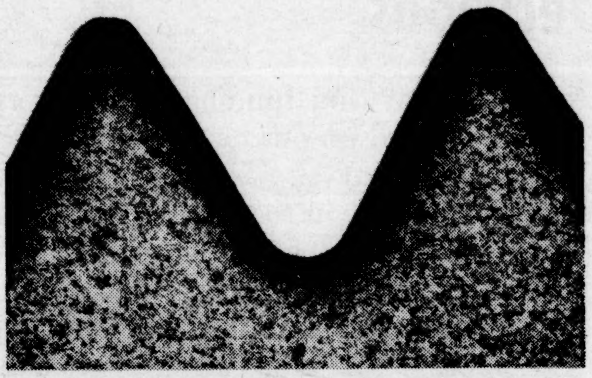
The budget makes no mention of the increasing fatigue problems being encountered by Strategic Air Command with its heavily loaded B-52 fleet due to conditions encountered during refueling operations and high gross weight takeoffs, although these problems raise serious questions as to how long this fleet will remain effective even if armed with Skybolts. Although vague mention is made of studies proposed for a new type of bomber aimed at functioning in the environment of a U. S.-USSR ICBM capability and Dyna-Soar is getting a significant funding boost, we suspect that this manned vehicle gap may become critical during the decade ahead unless more vigorous thought and action is applied.

Certainly the budget increases aimed at more effective limited war capability are long overdue. Although these increases are relatively small compared with the ICBM boosts, they show firm determination to proceed in these long neglected areas and activate a number of significant projects for the future, such as the $45 million for the tri-service STOL fighter and $172 million for increased jet-powered airlift.

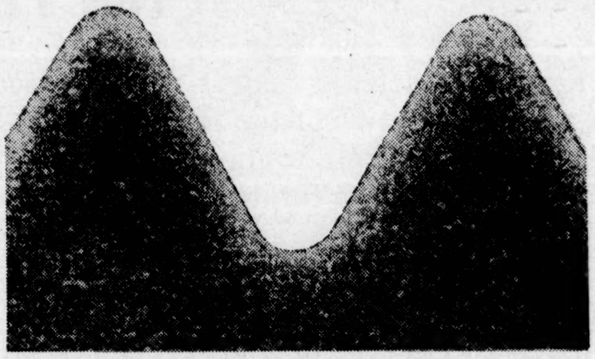
The action to begin the thorny but long overdue task of closing down military bases and installations no longer necessary to support the changing technical pattern of defense should be welcomed by taxpayers regardless of the impact on specific local economies.

The decisions in the new defense budget message are but the first in a pattern that will unfold during the next year. They are certain to stir bitter debate in Congress, and we can expect Kennedy Administration officials to be unusually articulate in their defense.

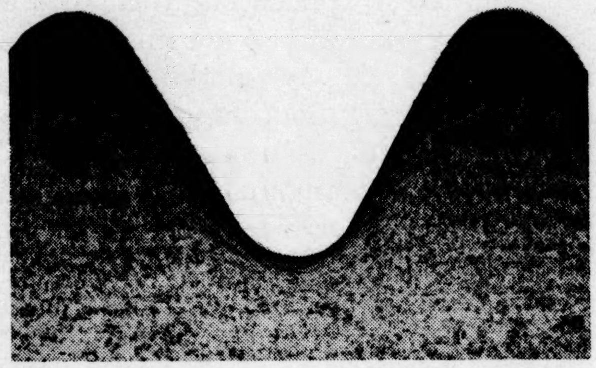
—Robert Hotz



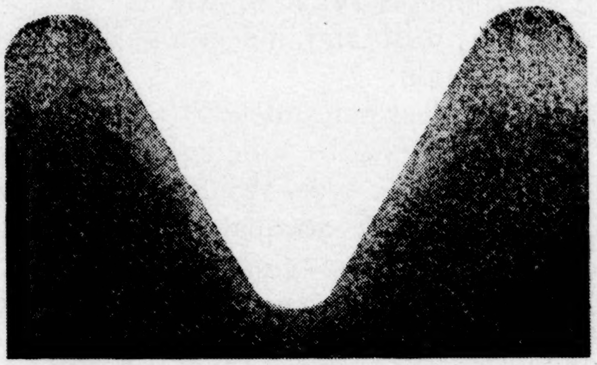
Carburization because of faulty atmosphere control during heat treatment. Surface carburization—indicated by dark layer—results when bolt is heat treated in high carbon atmosphere after threads are rolled.



Decarburization because of improper atmosphere control during heat treatment. A low-carbon atmosphere will produce a decarburization band along the entire thread profile.



Severe carburization on thread crests because, when threads were rolled after heat treatment, a heavy layer of carbon was pushed up into the crests.



Decarburization on thread crests because of decarburized bar stock. A .005-in. layer of decarburization on the raw stock can create .014 in. of decarburization on the thread crests after thread rolling.

Carburization and Decarburization:

Either can cut a bolt's fatigue life in half!

Too frequently, carbon content on the surface of a bolt is ignored—by both user and maker. Yet to neglect this problem is, very simply, to court disaster.

Carbon—and carbon alone—gives steel its hardness after heat treatment. Thus the carbon content of a bolt is extremely important.

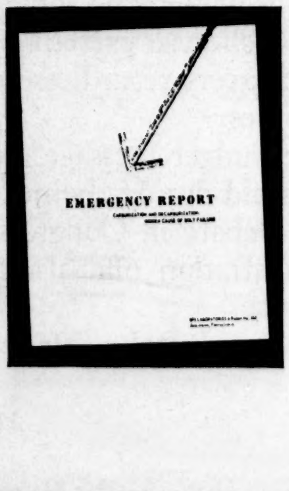
Carburization occurs chiefly when a high carbon atmosphere comes in contact with the bolt during heat treatment. The result is a hard surface layer of carbon which increases the notch sensitivity of the threads and of the head to shank fillet. An added danger is the greater susceptibility to hydrogen embrittlement.

On the other hand, when steel is heated above a certain temperature in a carbon-poor atmosphere, the carbon content of the surface is depleted. How serious is this decarburization? A reduction in surface carbon of as little as 1/10 of 1% can reduce the fatigue life to as low as 1/3 of its original value.

Carburization and decarburization are not uncommon. Bolt manufacturers must be unfailingly vigilant to prevent their occurrence. At SPS the maintenance of an absolutely neutral atmosphere during heat treatment is fundamental. Moreover, for critical bolts SPS removes metal to eliminate surface decarburization and other defects found in the raw material. Attempts to achieve this by carbon restoration treatments in critical bolts will not be successful.

SPS has adopted a method of detecting carburization and decarburization which it uses to check *all high-strength fasteners*. Microexamination is not always enough. The SPS procedure provides for checking the bolt surface by microhardness testing with a diamond pyramid indenter to which a load of 200 g is uniformly applied.

How stringent are SPS requirements? Decarburization is considered to exist when hardness is more than 25 VHN (approximately Rc 2 points) less than the average cross sectional hardness.



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WHO'S WHERE

In the Front Office

Fred H. Rohr, president of Rohr Aircraft Corp., Chula Vista, Calif., succeeding **J. E. Rheim,** resigned for reasons of health. Mr. Rohr continues as board chairman and chief executive officer.

August W. Compton, president, Leigh Fisher Associates, Inc., San Francisco, Calif., succeeding **Leigh Fisher,** who will continue to handle special projects for the firm.

Jack Kuhner, vice president-administration, Hoffman Electronics Corp., Los Angeles, Calif., and **H. Edward White,** director-industrial relations. **Capt. Will I. Bull** (USN, ret.), succeeds Mr. Kuhner as general manager of the Military Products Division. **Marvin G. Whitney** succeeds Capt. Bull as director of operations for the Semiconductor Division. Also: **Theodore S. Hoffman,** director of operations, Evanston, Ill., facility of Semiconductor Division, succeeding **Joseph S. McGee,** now director of finance at the Division's El Monte, Calif., facility.

Jack Sinder, vice president and assistant general manager, Poly Industries, Pacoima, Calif.

J. Ray Gilmer, vice president-marketing Varo, Inc., Garland, Tex.

Charles R. Speers, vice president in charge of a newly created Traffic Administration and Development Department, American Airlines, Inc.

Edwin F. Beacham, vice president-operations, Connector Division, Viking Industries, Inc., Canoga Park, Calif.

Zeke R. Smith, executive vice president and general manager, Potter & Brumfield, Division of American Machine & Foundry Co., Princeton, Ind., succeeding **H. L. Huntsinger,** resigned.

Edmund M. Velten, vice president-production, The Beryllium Corp., Reading, Pa.

Charles P. Bellican, vice president-plans and programing, The Decker Corp., Bala Cynwyd, Pa.

Bernard B. Smyth, assistant vice president, General Atomic Division, General Dynamics Corp., San Diego, Calif., with offices in Washington, D. C.

Col. Aldro Lingard, chief of the Test and Experimentation Division, Federal Aviation Agency's Bureau of Research and Development, with headquarters at Atlantic City, N. J.

Dr. Charles H. Townes will become Provost of the Massachusetts Institute of Technology in the fall. At present Dr. Townes is on leave from his post as Professor of Physics at Columbia University and is serving as vice president and director of research for the Institute of Defense Analyses, Washington, D. C.

Maj. Gen. T. Alan Bennett will become Director of Maintenance Engineering, Air Materiel Command, Wright-Patterson AFB, Ohio. **Brig. Gen. Richard W. Fellows** will be the Deputy Director.

William W. Drake, Jr., corporate treasurer, and **Robert T. Jensen,** assistant secretary and general counsel, Aerospace Corp., El Segundo, Calif. Mr. Drake continues as vice president-administration.

(Continued on page 101)

INDUSTRY OBSERVER

▶ Four companies studying reactor in-flight test system (RIFTS) were scheduled to brief National Aeronautics and Space Administration Apr. 1. Studies —to recommend the best reactor flight-test approach, facilities needed and program economics—were conducted by Lockheed and Martin under contract and by Douglas and Convair with their own funds.

▶ Navy is studying a variety of non-acoustic means for detecting submarines in its Cutwater program. The project covers infrared, electromagnetic and other approaches.

▶ Source selection board is expected to take six to eight weeks to evaluate the seven bids received on the Project Relay active repeater communications satellite (AW Mar. 27, p. 25). The NASA satellite will have all solid state electronics except for transmitter power tubes.

▶ Avionics industry is expected to propose a number of ways of applying recently developed technology to the small war capability now being emphasized by the Defense Department. Efforts by industry and Wright Air Development Division laboratories to interest Tactical Air Command in new avionic technology previously has been stymied by TAC's lack of funds.

▶ NATO requirement BMR-3, specifying minimum and desired performance for a VTOL strike fighter to replace the Fiat G.91, is being circulated in SHAPE for comment. SHAPE is expected to ask for proposals next month, with the possibility that a contract will be awarded before the end of the year. Major contenders are the Hawker P.1127, Fiat G.95 and Fokker-Republic team's variable sweep proposal.

▶ First live firing of a USAF-Martin Titan I from the Silo Launch Test Facility at Vandenberg AFB, due within a few weeks, will involve a dummy second stage filled with water and will go for only a short range. Operational Titan I will not be fired from inside silos. The SLTF tests with Titan I are to determine how Titan II, which will be fired from holes, will perform.

▶ Strengthening of the conical portion of the Convair Atlas D boosters for the Mercury program requires use of 0.041-in. thick steel instead of the 0.011-in. thickness used for other D models. Thicker steel also is used for Atlas boosters in the Midas and Samos programs.

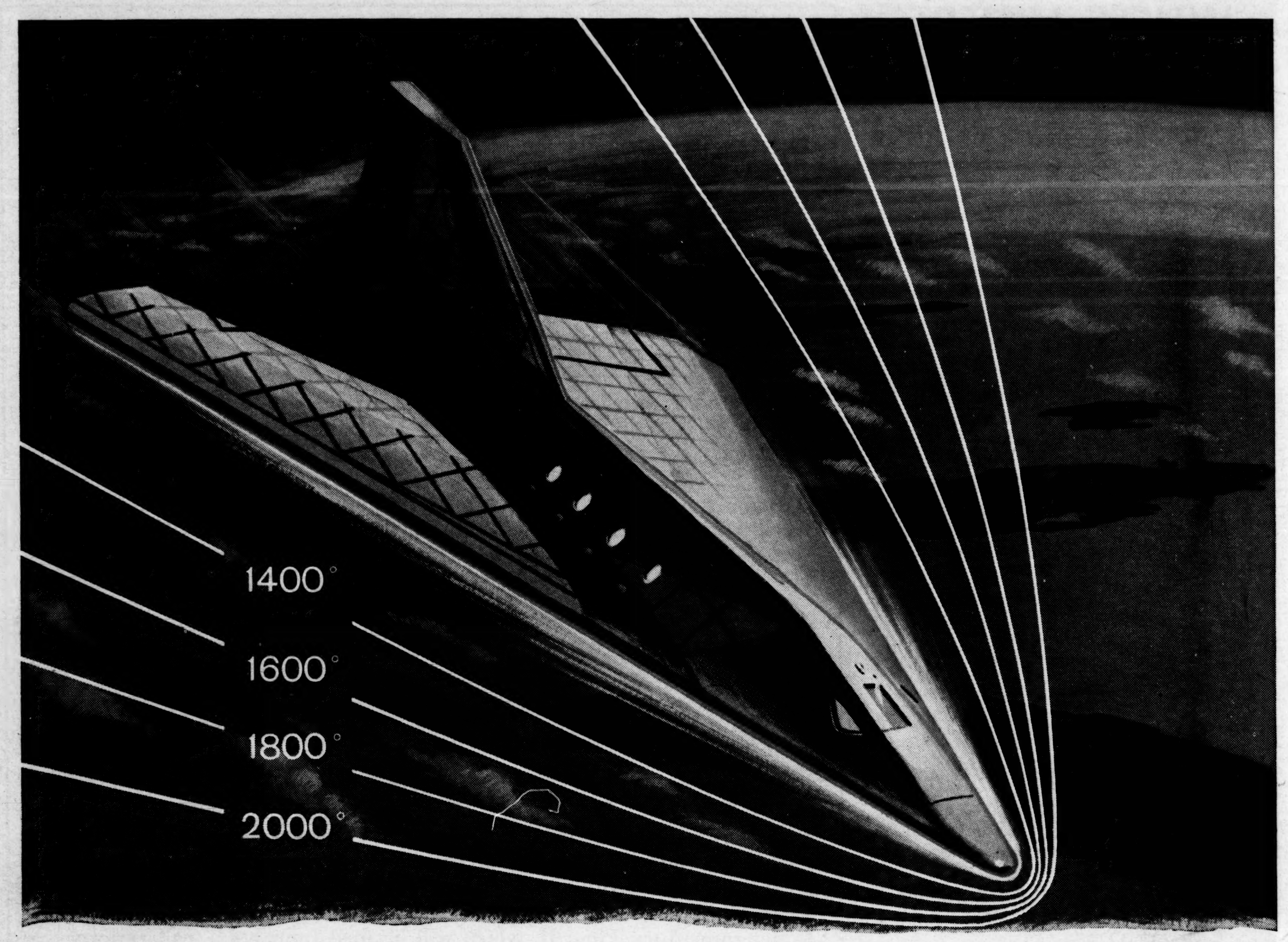
▶ Grumman has made more than 20 test flights with the contact analog display in its A2F avionics aircraft. Display features television presentation of simulated terrain and clouds, with the airplane flight path indicated by a superimposed "highway" marked with lines for pitch commands, plus indicating shapes for other commands. Very few discrepancies have been reported, but early tests indicate the need for a brighter picture tube with a non-reflective face to improve quality and legibility of the presentation.

▶ Bristol Siddeley BS.53 engine being developed for VTOL applications solves the problem of thrust proportioning for takeoff and cruise flight by using plenum chamber burning of the bypass air to increase lifting thrust during the VTOL phase. No afterburning is used for high speed flight, but some work is aimed toward afterburning in the split-nozzle "trousers" exhaust section to improve thrust control.

▶ Air Force Ballistic Missile Division has asked Martin to study possible use of the Lockheed Agena B stage with Titan II to launch military space payloads.

▶ Wright Air Development Division is supporting industry study of the effects of radiation weapons in the atmosphere and space. The study is expected to be completed by the middle of this year.

▶ All research and development firings of the USAF-Convair Atlas F model will be made from Vandenberg AFB, rather than Cape Canaveral, Fla. The F model will be stored in silos and raised by elevator, and no Atlas silos are planned at Cape Canaveral.



Atmospheric Skin Diver... 1980 Style

Double-walled honeycomb panels of HAYNES alloy No. 25 may form the "skin" of a rocket-propelled space glider, predicts a major aircraft company. Already successfully tested, these panels are designed to withstand the terrific temperatures generated as the glider dives back into the earth's atmosphere.

To safeguard the plane's 30 passengers and crew from this blazing re-entry heat, its whole skin, except for leading edges and tail surfaces, will be made of the HAYNES alloy No. 25 panels. Beneath these, a layer of thermal insulation. And liquid circulating through inner walls and airframe will lose excess heat to water to be expended as steam.

Research indicates that a "skin" of this basic type is highly practical. And it seems certain that many other tough, heat- and erosion-resistant HAYNES alloys—some already proved at 2,000 deg. F. and above—will also be aboard.

Whether investment- or sand-cast, rolled, wrought, vacuum melted or air melted, there's a HAYNES high-temperature alloy to meet your needs.

Engineers discuss double-wall test section of space-plane skin with a honeycomb surface panel made of HAYNES alloy No. 25, designed to withstand intense heat of re-entry.

Address inquiries to Haynes Stellite Company, 270 Park Avenue, New York 17, N. Y.

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Washington Roundup

Balanced Space Effort Endorsed by Kennedy

President Kennedy finally has addressed himself directly to the tug-of-war between the military services—chiefly the Air Force—and the National Aeronautics and Space Administration over space missions and dollars. There is consolation for both sides in what he has to say.

On Mar. 9, Chairman Overton Brooks of the House space committee wrote to the President expressing concern over the "quasi-public fashion" in which military use of space was being promoted and over the implication that the executive branch was contemplating "a radical change in our national space policy" that would accentuate military space "at the expense of civilian and peaceful uses." Last week, the White House agreed to let Brooks release the President's reply, dated Mar. 23.

"It is not now nor has it ever been my intention to subordinate the activities of [NASA] to those of the Department of Defense," he said. Contrary to the view of his predecessor, President Kennedy said he believes "that there are legitimate missions in space for which the military services should assume responsibility." But he said there are "major missions, such as the scientific unmanned and manned exploration of space and the application of space technology to the conduct of peaceful activities, which should be carried forward by the civilian space agency."

The President said the national space council will no longer be "just a box on an organizational chart," and said he will rely on Vice President Lyndon Johnson, the council, the congressional committees, and private industry for a strong civil program.

U. S.-Soviet Bilateral

U. S. airline officials were given a closed-door briefing last week by Civil Aeronautics Board on its step-by-step program for negotiating with Soviet Russia for a reciprocal exchange of operating rights on the New York-Moscow route.

The meeting followed State Department's second bid for the route since President Kennedy took office. Russia did not respond to the first note, handed to the Soviet embassy here Feb. 21, although it was generally known that the embassy was under instructions from the Kremlin to sound out congressional opinion on the proposed route.

U.S. still is not eager for a negotiating session, but for the first time since the New York-Moscow question was broached in 1958, the government has at least solidified its approach. Proposals will be based on a simple New York-Moscow route, with tight provisions for schedule frequency and traffic capacity. Pan American, which was granted the route by CAB right after World War II, would negotiate technical details with the Soviet airline, Aeroflot, once the governments reached general agreement.

The agreement will not follow the pattern of the Bermuda agreement, since Russia is not a member of either the International Air Transport Assn. or the International Civil Aviation Organization.

Latest Pentagon management decision to be held under extremely tight internal security is consolidation of direction of geodetic survey and mapping. Announcement of the decision was due late last week. Defense Secretary Robert McNamara, prodded by the House Government Information Subcommittee over his inquiry into protection of security information, said he will try to ensure "the fullest possible flow" of releasable information.

But he said "true security information must be protected to the maximum extent possible." He is applying the same yardstick to management decisions until he is ready to talk about them.

Manned Bomber Flap

Biggest fight over President Kennedy's proposal to cut the B-70 Mach 3 bomber back to a development project may come inside the Air Force rather than on Capitol Hill. Congress—partly because contracting for a full weapon system would have been spread through so many states—may press for more than the White House wants.

But within the Air Force, manned bomber advocates already were storming Secretary Eugene Zuckert's office last week to protest. Zuckert is expected to support the McNamara-Kennedy decision. The President did not ask for any increase in B-52 or B-58 strength, further shattering the hopes of those who see a need for manned bombers.

A small glimmer of hope remained in the President's words that a B-52 "or successor bomber" equipped with Skybolt might be as useful as a B-70, and in his statement that "We should also explore the possibility of developing a manned bomber system specifically designed to operate in an environment in which both sides have large ICBM forces."

The similarity between the President's lack of enthusiasm for the B-70, nuclear aircraft program, Missileer-Eagle combination and the liquid-fueled Atlas and Titan and the views of President Eisenhower did not go unnoticed.

—Washington Staff

Kennedy Stresses Solid Rockets, Limite

Defense budget request increased $1.954 billion; Polaris emphasized, B-70 cut back, ANP canceled.

By Larry Booda

Washington—President John F. Kennedy last week placed sharply increased emphasis on solid propellant ballistic missile delivery of nuclear weapons and accelerated preparation for handling non-nuclear limited wars in asking Congress for $1.954 billion in additional new obligational authority over the Fiscal Year 1962 Eisenhower budget request.

The President further emphasized the shift from aircraft to missiles by curtailing the B-70 Mach 3 bomber program from a complete weapon system to a flying prototype. He also canceled or reduced a number of other programs, including development of nuclear aircraft engines.

Major recipient of the new money will be the Navy's Polaris fleet ballistic missile weapon system, which is scheduled to receive an additional $1,340.8 million. Air Force's silo-launched Minuteman intercontinental ballistic missile will receive $96 million more and Skybolt air-launched ballistic missile program will receive $50 million.

A total of $581.9 million is earmarked for limited war research, procurement of weapons and transport and personnel increases aimed at increasing limited war capability.

President Kennedy coupled his budget recommendations with a statement which said: "Our arms will never be used to strike the first blow . . . We must offset whatever advantage this may appear to hand an aggressor by so increasing the capability of our forces to respond swiftly and effectively to any aggressive move as to convince any would-be aggressor that such a movement would be too futile and costly to undertake."

Deterrent Concept

In referring to deterrence of deliberate nuclear attack, he said, ". . . This deterrence does not depend upon a simple comparison of missiles on hand before an attack. It has been publicly acknowledged for several years that this nation has not led the world in missile strength . . . But what we have and must continue to have is the ability to survive a first blow and respond with devastating power. This deterrent power depends not only on the number of our missiles and bombers, but on their state of readiness, their ability to survive attack and the flexibility and sureness with which we can control them."

Mr. Kennedy recognized that arms must be subject to ultimate civilian command and control. To that end he committed more funds to building a communications system which, in as short a time as possible, would enable the President to learn that an attack is on its way and then order appropriate action.

On the subject of less than all-out war, Mr. Kennedy said: "The strength and deployment of our forces in combination with those of our allies should be sufficiently powerful and mobile to prevent the steady erosion of the Free World through limited wars; and it is this role that should constitute the primary mission of our overseas forces . . . Our objective now is to increase our ability to confine our response to non-nuclear weapons, and to lessen the incentive for any limited aggression by making clear what our response will accomplish."

Increases requested in programs actually amount to $2.704 billion. This amount would be reduced by $750 million resulting from recommended cancellations and curtailments and by transfers from capital funds of military activities which operate at a profit. Of the new funds asked, $650 million would be spent in Fiscal 1962.

Project Cancellations

Savings would come from the following actions:

- **USAF-Martin Titan II,** storable liquid-fueled ICBM fired from silos, would be reduced from 14 to 12 squadrons at a saving of $100 million. Remaining request for all Titans for Fiscal 1962 would be $1,054.8 million.
- **Phaseout of USAF-Boeing B-47** medium bomber wings, delayed last summer to maintain an alert after the collapse of the summit meetings, would be accelerated at a saving of $34.7 million.
- **USAF-Northrop Snark** intercontinental cruise missile, now based only at Presque Isle, Me., would be phased out, saving $6.9 million.
- **USAF-North American B-70,** which had previously been cut back to an airframe prototype system during the Eisenhower Administration and then was increased last year to a 12-plane weapon system program after intense political pressure had been exerted, now would be cut again to four planes, limited to airframe engines and bombing navigation systems. Saving would be $138 million, leaving $216 million in the fiscal 1962 budget request instead of $354 million.
- **Nuclear-powered aircraft** would be taken from Air Force cognizance and given completely to the Atomic Energy Commission. USAF had asked $35

Revised Defense Budget Summary

(Millions of Dollars)

	New Obligational Authority			Net Expenditures		
	FY 1960 Actual	FY 1961 Estimate	FY 1962 Estimate	FY 1960 Actual	FY 1961 Estimate	FY 1962 Estimate
1. Eisenhower budget (FY 1962 budget document)	40,627.9	41,308.1	41,840.3	41,214.8	41,500.0	42,910.0
A. Effect of actions taken prior to 1/20/61 and underestimate	....	....	....	....	743.4[2]	190.0[2]
B. FY 1961 supplementals proposed for later transmission[1]	....	63.0	....	....	18.0	45.0
2. Adjusted budget 1/20/61	40,627.9	41,371.1	41,840.3	41,214.8	42,261.4	43,145.0
C. Effect of actions taken after 1/20/61 to accelerate FY 1961[3]	....	....	....	....	214.1	5.0
3. Adjusted budget with accelerations	40,627.9	41,371.1	41,840.3	41,214.8	42,475.5	43,150.0
D. Effect of President Kennedy's budget message	....	....	1,954.0	....	24.5	650.0
4. Budget proposed by President Kennedy	40,627.9	41,371.1	43,794.3	41,214.8	42,500.0	43,800.0

[1] Underestimate of Retired Pay ($15.0) and Constellation fire damage ($48.0).

[2] Underestimate of rate of expenditure of funds.

[3] Acceleration of approved procurement and construction actions in order to strengthen the military forces and stimulate the recovery.

War Forces

million for Fiscal 1962. This request would be eliminated. AEC requested $33 million for research funds plus $2 million for operating expenses. There is doubt if this sum will enable work on both General Electric's direct cycle engine approach and the Pratt & Whitney indirect cycle. The program has been the subject of controversy and changes in status over a period of 10 years.

- **Navy's Eagle-Missileer** air defense system would be canceled completely. The Douglas Missileer aircraft, which was not funded in the Eisenhower budget, would have carried the long-range Bendix Eagle air-to-air missile. The saving by canceling Eagle would be $57.7 million. Eagle also was considered for use in a Boeing-Bendix air defense concept called Project Aerie. This would have used modified Boeing KC-135 tankers as flying radar stations carrying search and attack radar and acting as airborne command centers that could fire up to 24 Eagles each. The aircraft would have been ground-based, would have had a 5-min. reaction time, and would have been able to operate with the Sage air defense control system or independently, remaining on station for as long as 11 hr. The President said "no alternative use" for Eagle is in prospect now.
- **Installation of the Navy-Lockheed Polaris** on the nuclear-powered cruiser Long Beach would be canceled at a saving of $57.7 million. Mr. Kennedy said the money would be better spent on the far less vulnerable Polaris submarines.

An additional saving is claimed by transfer of funds from such activities as the Military Air Transport Service and the Military Sea Transport Service which charges users for the service and show a profit.

The President's actions indicate that he believes there is a missile gap in reference to the Communist bloc capability, but not necessarily an over-all deterrent gap. The increase in ballistic missile funds is aimed at having an additional 202 of them available by 1964. Of this total, there would be 160 Polarises, two thirds of which could be on station at any given time. This is not considered enough missiles to close the gap at that time, but sufficient strength in bomber delivery capability would be available.

Proposed Changes—FY 1962 Defense Budget

New Obligational Authority

(Millions of Dollars)

Program	Proposed Adjustments
Strategic Systems	
Polaris	$1,340.8
Minuteman	96.0
Skybolt	50.0
Increased ground alert force and bomb alarms	44.6
Midas	60.0
Backup control of air defense interceptors	23.0
Improved command and control of strategic deterrent	16.4
Research, including penetration aids, Dyna-Soar, Advent, Defender, Discoverer and others	226.0
Limited War	
Expanded research on non-nuclear weapons	122.0
Additional transport aircraft	172.2
Additional amphibious transport of new type	39.7
Navy ship rehabilitation and modernization	84.4
Procurement of new weapons, ammunition, etc	230.0
Development of advanced tactical fighter	45.0
Modification of F-105 tactical fighter	24.6
Increase in personnel strength	39.0
Increase in retired pay	25.9
Increased readiness training, Army and Air Force	65.3
Cancellations and Reductions	
Elimination of two Titan II squadrons	—100.0
Accelerated phaseout of B-47 bomber wings	— 34.7
Phaseout of Snark operational missile	— 6.9
Reduction in B-70 program	—138.0
Change in status of aircraft nuclear propulsion work	— 35.0
Cancellation of Eagle missile	— 57.7
Cancellation of Polaris installation on Long Beach	— 57.7
Transfer from working capital funds (MATS, MSTS, etc.)	—320.0
Total increase in request NOA	$1,954.0

It is estimated that there will be 1,300 missiles available by 1965 and 1,750 missiles by 1966, unless present goals are altered. This would consist of 474 Polarises under a 29-submarine program; 1,000 Minutemans, and the remainder Titan II's. By that time it is planned that Atlas and Titan I would be removed from service because of high cost in keeping them ready for firing.

The Polaris program, already one of top priority, was accelerated soon after the President took office when he ordered more rapid construction of five submarines. The total number of subs authorized at that time was 19. Now the goal has been increased by 10. By 1963 it is planned to construct them at the rate of one per month. All 29 are expected to be operational by 1965, two years earlier than under the present building rate of five per year.

Development of the Polaris missile also will be accelerated. The present operational Polaris has a range of 1,200 mi. In order to save on procurement on the 1,500-mi. A2 version and get the 2,300-mi. A3 a year earlier, the President recommended concentrated effort on the A3.

"This longer range missile with improved penetration capability will greatly enhance the operational flexibility of the Polaris force and reduce its exposure to shore-based anti-submarine warfare measures," the President said.

Of the $1.34 billion in new funds for Polaris, $270 million will be spent in 1962. Additional crew requirements will necessitate the addition of 3,000 men at a cost of $15 million. Additional funds are also provided to allow more crew training and practice firings.

The mobile version of the Minuteman ICBM, which is intended for deployment aboard railroad trains, will be kept in a research and development status. Three of the planned mobile squadrons will be canceled and three squadrons added to the fixed version, which will be fired from silos. Each fixed squadron has 30 missiles.

Minuteman production capacity will be doubled. There will be no second source as such because there is already a wide representation among contractors in the program who can increase or diversify their efforts. Some of the $96 million will go into design changes to improve reliability, guidance accuracy, range, and re-entry ability so these changes can be incorporated earlier than previously planned.

The Eisenhower request for Minuteman was $917.8 million. The new figure will be $1,013.8 million. More missiles will be made available for practice firings, which—as in the case of the

Project Slam Contract Negotiated

Dallas, Tex.—Sharp increase in level of USAF participation in development of the nuclear ramjet-powered supersonic low-altitude missile program, Project Slam, was indicated when it began negotiating a continuing study contract, estimated at $1 million, with Chance Vought here last week.

Contract calls for Chance Vought to provide aerothermodynamic data in support of the Lawrence Laboratory's Pluto ramjet powerplant project, covering a period of a year. Data will be aimed at providing Lawrence Laboratory and Marquardt Corp. with information including parameters for design of suitable engine air inlets and other components suitable for a flight engine.

Contract announcement was made here by William Weitzen, deputy assistant for development, staff of the secretary of the Air Force. Sources associated with the project emphasized that studies did not entail design of an airframe to be used for a flight vehicle. Such a design decision would have to await further research and development to further prove the feasibility of the Pluto program. When and if a decision is made to proceed on an airframe design, USAF probably would invite industry proposals. Importance of the contract is that it gives Chance Vought a favored position in event of such a competition, Aviation Week was told.

Chance Vought won the study contract in competition with North American Aviation and Convair on the basis of evaluation of proposals submitted by the three firms, at the end of February, to Wright Air Development Division's Advanced Systems Planning Office of Directorate of Advanced Systems Technology.

Prior study by the firm has been carried out largely on a company-funded basis, with little USAF aid. The new contract increases the funding "many, many times" over previous levels, an Air Force source reported.

Polaris—should provide more operational data sooner.

The 1,000-mi.-range Skybolt missile, designed to provide a stand-off capability for the Boeing B-52 bomber, has been funded for $50 million. No new funding had been provided in the Eisenhower budget.

Additional funds for an airborne alert would be used to increase the 15-min. ground alert force from one-third of the estimated 1,500 bombers to one-half. Replenishment spares will be purchased to enable the establishment of an airborne alert of one-eighth of the force. An increase of 2,000 personnel is included.

The Midas infrared early warning satellite, intended as a means of spotting ICBM's shortly after they are launched, would receive an additional $60 million under the proposed changes, making a total of $201 million. A small portion of the money will go to establish bomb alarm systems at Ballistic Missile Early Warning stations. The alarm would indicate whether a communication failure between the station and command headquarters was due to a bomb attack.

For continental air defense, communications improvements will involve $23 million.

Army's Nike Zeus anti-missile missile defense system will be funded for $258 million for research and development—no change from the Eisenhower request—but no money will be provided for production items. Recent testimony in Congress by Army officials has strongly urged the limited production of long-lead time items. Funding for this probably will await successful demonstration of the system against ballistic missiles over the Pacific Missile Range.

A package of $226 million additional was asked by the President for a variety of research and development items such as penetration aids, the USAF-Boeing Dyna-Soar boost glide orbital vehicle, Army's Advent communications satellite, the Defender anti-ICBM study program, the USAF-Lockheed Discoverer recoverable capsule satellite, and others. Original budget requests included $1 million for Aerospace Plane, $20 million for Discoverer, $70 million for Dyna-Soar, $10 million for the Blue Scout rocket family, $7 million for the USAF-North American X-15, $12 million for the Saint inspection satellite, $3 million for recoverable boosters, and $276 million for the USAF-Lockheed Samos reconnaissance satellite.

In the limited war area there will be concentration of research on non-nuclear weapons. Additional amount requested is $122 million.

For airlift modernization $172.2 million extra would be added to the $141 million requested in the Eisenhower budget, making a total of $313.2 million. The breakdown of the aircraft purchase is 30 Boeing C-135s costing $117 million, already ordered; 99 Lockheed C-130Es, of which 50 are in the Fiscal 1961 program, 23 of which have been added by President Kennedy to the Fiscal 1962 budget, and 26 C-130Es which originally were intended to be C-130Bs.

The first C-135 is due in June and the whole order by early summer of 1962. Ten C-135s were financed by the reprograming of Fiscal 1960 funds, and 20 from Fiscal 1962 funds.

Of the C-130Es, 50 are earmarked for MATS. Of these, 34 will be financed through Fiscal 1962 funds and 16 from Fiscal 1961 funds. The first of these aircraft will be delivered in March of 1962 and the balance by March of 1963.

Whether the remaining 49 C-130Es will be assigned to MATS or the Tactical Air Command, or perhaps any future combination of the Strategic Army Corps and TAC has not been decided.

A new type of amphibious transport requested by Mr. Kennedy (see p. 27) is described as an LPD, which would have a flat deck for carrying cargo helicopters used for ferrying materiel from ships to shore. The Navy already has LPHs which are used for assault helicopter operations.

Navy was given more funds for ship and aircraft maintenance and overhaul. Many Navy aircraft had been stored because of a shortage of overhaul funds.

Largest limited war item is in new weapons and ammunition—$230 million. No breakdown of spending was indicated by Mr. Kennedy, although most of the money will go to the Army, which has recently stated its requirements in this area as $1 billion.

Development funds for an advanced tactical fighter, or TFX, will account for $45 million. This joint-service short takeoff and landing aircraft will also be capable of operations from an aircraft carrier. It will replace the proposed Eagle-Missileer for Navy use.

Modification of the USAF-Republic F-105 tactical fighter to give it the ability to operate from small fields in advanced areas and carry and fire non-nuclear weapons will cost $24.6 million. This would include use of a more powerful engine or JATO for takeoff, an arresting system for landing, and modification of the fire-control system for firing rockets and other conventional weapons.

Modest increases in personnel are included—5,000 for the Army and 3,000 for the Marine Corps. Readiness training for Army and Air Force units accounts for $65.3 million.

Umbaugh Contract

Fairchild Engine & Airplane Co. and Umbaugh Aircraft Corp. are seeking to settle the future of manufacture of the Umbaugh U-18 autogiro by Fairchild. Termination is possible of a contract under which Fairchild produced five prototype U-18s, but the equities of each must be negotiated.

An active certification program is under way at Hagerstown, Md., but Federal Aviation Agency pilots have not yet flown the ship.

Congress Favorable to Budget Changes

Washington—Congress last week appeared inclined to accept President Kennedy's new defense program without substantial change—with the possible exception of his proposal to reduce the B-70 Mach 3 bomber program by $138 million in Fiscal 1962.

The January budget message of former President Eisenhower included $358 million for this program which has strong congressional support, particularly in the Senate. Last year, Congress increased funding for it from $75 million to $365 million against the Administration's recommendation.

There is also scattered congressional support for additional funds to move the Nike Zeus anti-missile missile into production; to proceed with the construction of a "fly early" aircraft nuclear propulsion program; and to modernize the ground forces more extensively than proposed by the President.

The President's decision to close 73 bases and installations, domestic as well as foreign, will probably be the most difficult for Congress as a whole to swallow. The direct impact on many small communities will be great. The extent of congressional opposition will hinge on steps taken by the Administration to ease hardships, as promised by the President.

Congressional leaders — including House Speaker Sam Rayburn (D.-Tex.), Senate Majority Leader Mike Mansfield (D.-Mont.), Chairman Richard Russell (D.-Ga.) of Senate Armed Services Committee, and Chairman Carl Vinson (D.-Ga.) of House Armed Services Committee—readily gave "general" endorsement to the President's program.

Sen. Stuart Symington (D.-Mo.), former secretary of the Air Force and probably the harshest congressional critic of Eisenhower defense policies, told AVIATION WEEK that his present inclination is to support the Kennedy program "as is." He commented that "everything considered, I believe that the new budget for the military is sound and constructive and proves that the President recognizes the conditions we face today in the nuclear space age."

House Reaction

Rep. George Mahon (D.-Tex.), chairman of the House appropriations subcommittee on the armed services, which will make the first decisions on Fiscal 1962 defense funds, told AVIATION WEEK:

"I was generally impressed with the President's program. It faces up to hard questions—for example on the aircraft nuclear propulsion program. I think it was a correct decision"—to reduce the programs under way at both General Electric Co. and the Pratt & Whitney Division of United Aircraft Corp. to a research level. "The increase in the Polaris program is highly desirable. I wish there were more for Army modernization. I am concerned over the reduction in the B-70—but I shall keep an open mind until I hear the testimony. An increase in the degree of readiness of our bomber forces is good.

"I expect industry lobbyists to be very active, and anticipate some controversy. But I think the tendency of Congress in connection with the defense program will be to give the new leadership the opportunity to lead."

Rep. Melvin Price (D.-Ill.) who, as chairman of the research and development subcommittee of the Joint Congressional Atomic Energy Committee, has been the major spokesman on Capitol Hill for the aircraft nuclear propulsion program, appeared resigned in his comment on the President's action:

"In view of the large expenditures to date, and the further expenditures required to achieve nuclear flight, I can understand the President's decision in relation to other competing demands for funds. I hope however that the President's message will not set a precedent for other atomic energy projects . . .

"I have pointed out many times that we could have had nuclear aircraft in flight today if it had not been for the 'on again, off again' system of mismanagement by the Defense Department and its scientific advisers. I can see the same approach creeping into the management of other defense projects and the Rover nuclear rocket program . . ."

General Electric termed the President's statements that the achievement of militarily useful nuclear flight is still "very remote" and that it would cost at least $1 billion to achieve first experimental flight as "in distinct contradiction to the information we have supplied to the government." GE stated that it has submitted a proposal to perform the first experimental flight in 1963 for less than $200 million, including the fabrication of the necessary powerplants, the modification of the B-52 airframe, the construction of the necessary facilities, and flight operation for two years.

The Convair Division of General Dynamics Corp. protested that the President's decision to order no more B-58 supersonic bombers, as well as curtailment of the B-70 program, "poses several grave national problems."

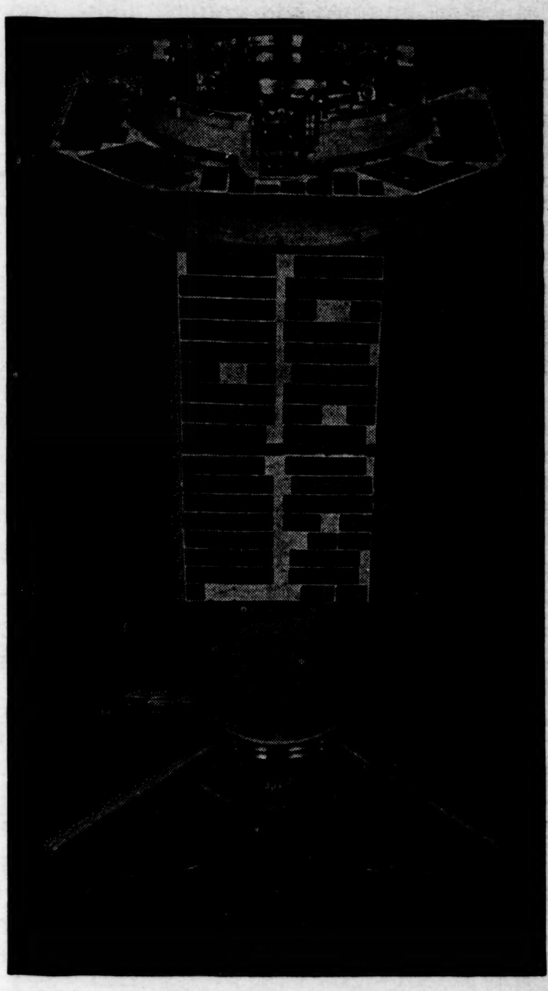
Ling-Vought Merger

Dallas, Tex.—Boards of Ling-Temco Electronics and Chance Vought Corp. last week tentatively approved a merger based on a stock-debenture exchange. Approval of stockholders of both companies will be sought in June.

Fred O. Detweiler, Chance Vought president, was moved up to chairman by the board last week and, in effect, out of the new company. Gifford K. Johnson, former executive vice president, was named president and chief executive officer, will become president of the merged company.

Robert McCulloch, now Ling-Temco chairman, will become chairman of the new company, and James J. Ling chairman of the executive committee.

Chance Vought stockholders would receive a $43.50 debenture for each share of stock which would bear 5½% interest and carry warrants for purchase of common stock of the new company. A conversion feature also will be included.



S-15 Satellite

S-15 gamma ray astronomy satellite is designed to sample energy and distribution of gamma radiation in a 300-700-mi. orbit. The 82-lb. National Aeronautics and Space Administration satellite is built around a telescope, the lens of which is at the top. Scheduled for Juno II launching soon, the package is designed to go into a controlled 10-rpm. tumble to scan radiation from earth and space. Lens is flanked by infrared sun and earth sensors. Lower portion of the 44-in. structure houses tape recorder, electronics and 12 nickel cadmium batteries. Command antenna operates on 138 mc., and tracking beacon on 108 mc.

Propulsion Key to NASA Budget Increase

By Edward H. Kolcum

Washington—President Kennedy has asked Congress to add $125.7 million to the Fiscal 1962 National Aeronautics and Space Administration budget, with 92% of the increase allotted to accelerate the Saturn, Centaur, F-1 and Rover propulsion programs.

The Kennedy budget requests $1,235,300,000 in new obligational authority for NASA, 11.3% more than the $1,119,630,000 asked earlier this year by the Eisenhower Administration. Spending estimates total $1.05 billion, an increase of $85 million over the previous Administration's budget.

The changes reflect a firm White House decision to spend more money for propulsion programs under way rather than to develop new large booster concepts in solid, liquid and nuclear engine technology. The new budget shows no interest in accelerating the man-in-space effort.

Effects of Revisions

Revisions in the program result in an increase of $99.7 million for research and development, $19.3 million for new facilities and $6.7 million for 780 new employes. Saturn C-2 program will get $71 million of the research and construction funds, expected to advance the operational date a year to 1966; $31.6 million will be added for Centaur; $9.3 million for the F-1, and $4 million for Rover.

The only non-propulsion increase comes in an additional $1.2 million for 180 new employes and $2.8 million to accelerate materials, structures, stability and control studies of supersonic transports.

President Kennedy eliminated an Eisenhower Administration provision which anticipated $10 million in industry contributions to development of communications satellite systems. This action has no effect on the pace of the communications satellite program, but postpones commercial participation in the funding during the development phase.

The new budget is noteworthy for some of its omissions. The decision to keep Apollo in the study phase is an obvious White House compromise made to obtain more booster money, because NASA had told Congress earlier that it is not satisfied with the $29.5 million requested for the multiman spacecraft (AW Mar. 20, p. 22).

Justification is that no Apollo hardware contract will be awarded in Fiscal 1962 because the extra funds available should be spent largely on boosters "which are the items most needed now," according to Administrator James E. Webb. The decision not to freeze the Apollo design on the basis of three study contracts due next month means work on the project in the coming 14 months will consist of mission analysis and research on heating, materials and loads.

Also surprising is the decision to concentrate the added funds on launch vehicles already under development, entirely excluding money for new concepts discussed by industry at a congressional hearing last month (AW Mar. 20, p. 50). As a result of the hearings, a bill has been introduced by Rep. Victor L. Anfuso (D.-N. Y.) to appropriate $30 million to NASA to be used exclusively for large solid rocket booster research.

Closing the Gap

Webb said President Kennedy's high interest in the civilian space program is indicated by his agreement to increase the NASA budget "at a time when money is hard to come by." He said the White House and NASA recognize the U.S. "is in a stern chase in space" with Russia in terms of booster capabilities and the hard judgment was made that the programs accelerated will give this country "a further capacity to close the gap."

The $71 million added to the Saturn C-2 program includes $56 million for accelerated development of the Rocketdyne J-2 hydrogen-oxygen engine. Cluster of four 200,000-lb. thrust J-2 engines will power the S-II second-stage for the second generation Saturn. With it, the vehicle is to be able to put 45,000 lb. in an earth orbit. Remainder of the added C-2 money includes $11 million to initiate construction of the Complex 37 launch pad at the Atlantic Missile Range, and $4 million for construction of a second static test stand at Marshall Space Flight Center.

Vehicle contractor for the four-engine S-II stage will be selected later this year following a bidders' conference at Marshall in May or June.

Centaur Accelerated

Addition of $31.6 million to the Centaur program includes $25.6 million for vehicle development and $6 million to modify AMR Complex 36-B to accommodate this vehicle. NASA was given complete responsibility for constructing the launch complex in an action which gave the Air Force complete responsibility for construction of Agena Complexes 13 and 14. As a result of juggling this responsibility, $8 million for Agena pads was deleted from the NASA budget and $6 million was added as the Air Force contribution for the Centaur pad.

Current estimates for the Centaur program, which NASA Deputy Administrator Dr. Hugh L. Dryden said will accelerate the program "by a number of months," now total $90.8 million, including the added Kennedy funds, $30.8 million in Eisenhower funds and $15.6 million in Fiscal 1961 supple-

National Aeronautics and Space Administration
Revised Fiscal 1962 Budget Requests
New Obligational Authority

	Previous	New	Adjustment
Research and development	$ 829,819,000	$ 919,539,000	$ 99,720,000(1)
Salaries and expenses	189,986,000	196,686,000	6,700,000
Construction of facilities	99,825,000	119,075,000	19,250,000
Totals	$1,119,630,000	$1,235,300,000	$125,670,000
Number of employes	17,342	18,122	780

Proposed Research and Development Changes

	Previous	New	Adjustment
Support of NASA plant	$ 74,310,000	$ 77,110,000	$ 2,800,000
Communications satellites	44,600,000	44,600,000	10,000,000(1)
Launch operations development	9,500,000	1,500,000	—8,000,000
Liquid propulsion	68,700,000	78,020,000	9,320,000
Nuclear systems	24,000,000	28,000,000	4,000,000
Centaur	30,800,000	56,400,000	25,600,000
Saturn	168,160,000	223,160,000	56,000,000

(1) Previous R&D request included contingency fund of $10 million for launching of industry-developed communication satellites and assumed that industry would repay NASA. NASA now does not anticipate industry participation this year, so the $10-million figure is no longer considered as anticipated revenue.

mental funds, plus the original $12.8 million launch complex budget.

The Kennedy budget adds $6.7 million in salaries and expenses to increase the number of employes by 780 to 18,122. Most of the new employes, 460, will go to Marshall to support Saturn acceleration. Research centers, probably Langley and Ames, will be increased by 180 employes to advance the supersonic transport program. Other increases will go to headquarters, 32; Goddard Space Flight Center, 70; Western Operations Office, 20, and the NASA-Atomic Energy Commission nuclear propulsion office, 18.

Increase of $4 million in the Rover program brings to $17.5 million the amount NASA plans to spend in fiscal 1962 for research on turbopumps and nozzles.

AEC was allotted another $5 million for Rover to be used for reactor development and tests.

The NASA budget changes were made after two weeks of review and two lengthy discussions between President Kennedy, Vice President Lyndon Johnson, Budget Director David E. Bell, Dr. Jerome Wiesner, the President's science adviser, Webb, Dr. Dryden and Dr. Robert C. Seamans, Jr., NASA associate administrator.

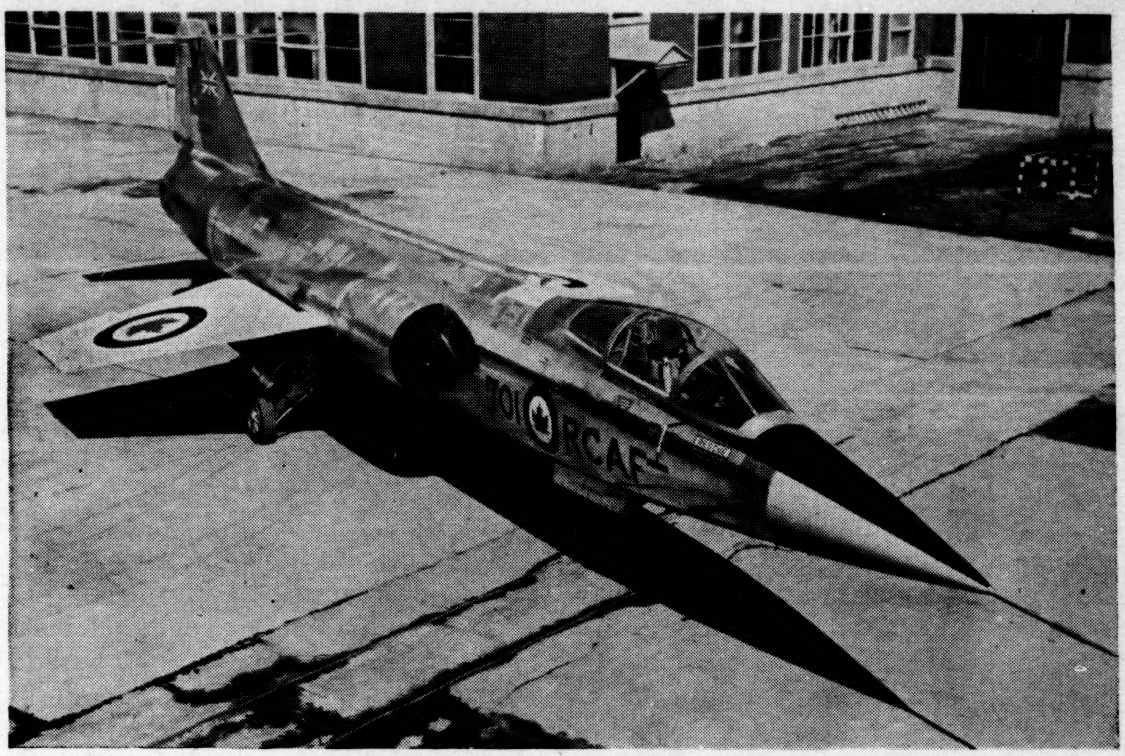
The budget review added $9.32 million to the F-1 program to keep the single-chamber, 1.5-million-lb. thrust engine on schedule. Total includes $9 million directly marked for engine development to assure a 1965 flight test, and the remainder is for purchase of liquid oxygen tank trailers.

Deleted from the budget, in addition to the $8 million for Agena launch facilities, was $700,000 for an animal enclosure at Ames Research Center (AW Mar. 27, p. 27), and $1.05 million for Relay communications satellite ground instrumentation.

Existing ground facilities will be used for the Relay program as a result of a shift in satellite frequencies (AW Mar. 6, p. 32).

Decision to postpone industry participation in the communications sattellite program came in order to retain complete development control in the government. Webb said further he doesn't think it fair to ask industry to assume risks at this time, since a decision has not been made on whether the eventual commercial communications satellite will be passive or active, or will orbit at low or high altitude.

The new budget gives NASA a foundation for proceeding with authorization hearings in Congress. Series of hearings on the broad Eisenhower Administration program were conducted by the House Committee on Science and Astronautics, but no money justifications were made pending the White House-NASA review.



Canadair CF-104 Prepared for RCAF Delivery

First in an order of 200 Canadair, Ltd., CF-104 supersonic strike-reconnaissance aircraft rolled out of the General Dynamics Canadian subsidiary's plant last week. First production plane and a second aircraft scheduled for completion in May will be flight tested by plane's designer, Lockheed Aircraft Corp. Burbank, Calif., Division. The Mach 2-plus fighter, powered by a General Electric J79 turbojet producing 15,000 lb. of thrust with afterburner, will enter service with RCAF No. 1 Air Division.

Transport Costs Cause Losses

New York—Writeoffs in 1960 on jet transport programs resulted in a $42.9-million loss for Lockheed Aircraft Corp. and $27.1 million for General Dynamics Corp.

Lockheed reduced its net loss for 1960 to $42.9 million as a result of second-half net income of $12.5 million. The loss stemmed from a mid-year decision to write off $67.6 million after taxes on transport aircraft programs. Lockheed reported net earnings of $8,733,000 for 1959.

Lockheed sales totaled $1,332,289,000 in 1960, compared with $1,304,287,000 for the year before. Backlog was $1.22 billion at the end of 1960; it was $1.16 billion at the end of 1959.

Breakdown of Lockheed's 1960 sales:

- **Missiles**—$397,349,000.
- **Satellites and spacecraft**—$290,923,000.
- **Military and commercial shipbuilding** and repair—$18,491,000.
- **Electronics end products**—$12,409,000.
- **Other new fields**—$3,317,000.
- **Aircraft,** spares and related services sold to U. S. government—$388,903,000.
- **Foreign government** airplanes, spares and technical services—$124,721,000.
- **Commercial aircraft,** spares and related services—$96,176,000.

General Dynamics Corp.'s 1960 net income before Convair 880/990 jet transport program charges totaled $53.2 million, but net costs of the 880/990 program amounted to $80.3 million, which resulted in the $27.1-million net loss. The corporation had net income of $31,056,069 in 1959.

General Dynamics' net sales for 1960 totaled $1,987,748,715 compared with 1959 net sales of $1,811,871,384.

Backlog of orders at the end of 1960 was $2.550 billion; it was $2.555 billion at the end of 1959.

General Dynamics estimates that its losses before taxes on the commercial jet transport program aggregated $167,194,000 at the end of 1960, compared with an estimated loss of $53,865,000 accumulated at the end of 1959.

Another aircraft company reporting 1960 financial results was Curtiss-Wright, which earned $10,031,167 on sales of $270,591,689, compared with 1959 earnings of $14,302,858 on sales of $329,188,469.

T. Roland Berner, company chairman and president, said Curtiss-Wright has a net worth of $204,219,903, substantial cash holdings and no funded debt.

Chance Vought Corp.'s downward trend in sales and earnings has been halted, company President Fred O. Detweiler stated in a report to stockholders.

Last year the company had net income of $3,894,455, equal to $3.27 per common shares in comparison with $4,899,856 or $4.12 per common share the previous year. Sales last year totaled $213,884,759 compared with $254,658,936 in 1959.

Probe Finds Unexpected Strength In Interplanetary Magnetic Field

Washington—Interplanetary magnetic field several times stronger than anticipated was measured to 112,500-mi. altitude by the Explorer X space vehicle launched in a highly elliptical trajectory Mar. 25 from the Atlantic Missile Range.

The Delta-launched payload transmitted data about 60 hr., and it was not known late last week whether the 78-lb. package was in an elliptical earth orbit or burned when it approached the earth after its probe mission. Its useful life ended after transmissions.

The payload contained a rubidium vapor magnetometer, two fluxgate magnetometers and a plasma probe designed to measure intensity and distribution of interplanetary magnetism, and to determine how much solar radiation is trapped by these magnetic fields. Measurements will be used in planning manned space flights and in studying solar-earth plasma relationships.

Pioneer V probe launched a year ago detected a steady magnetic field intensity of about 0.0002 gaus in interplanetary space. Preliminary findings from Explorer X indicated a field several times this intensity at altitudes above 56,000 mi., where earth's field ends.

National Aeronautics and Space Administration scientists are reducing data to arrive at precise measurements over the flight profile.

Explorer X was the fourth Delta mission in a 12-vehicle program and had the most difficult trajectory because rapid programing to a near-horizontal attitude at a low altitude induced high heat loads.

First-stage burnout occurred at 37 naut. mi. When the system was traveling at 15,000 fps., temperatures of 1,500-2,000F were being experienced on the payload fairing. Fairing was insulated with Teflon and withstood the high loads.

Second-state burnout came at 80 naut. mi. and carried the package to a velocity of 23,000 fps. The system coasted to 90 naut. mi., when the third stage ignited. Apogee was 112,500 mi., and perigee 110 mi.

Scientific instruments in the package made these measurements:

- **Magnetic field intensities** ranging from 0.01 to 7,000 gammas with the rubidium vapor magnetometer developed by Varian Associates. Instrument uses the principle of measuring the rate at which the rubidium 87 isotope spins around its nucleus. A gamma is 0.0001 gaus. Earth's field varies in intensity from about 0.15 to 0.5 gaus.
- **Solar plasma interactions,** densities and velocities, using a plasma probe developed by Massachusetts Institute of Technology (AW Mar. 20, p. 27).
- **Direction of weak magnetic** fields ranging in intensities from 0.5 to 25 gammas, using two fluxgate magnetometers designed by NASA's Goddard Space Flight Center and built by Schonstedt Engineering Co.

Goddard also built the payload structure and a sun aspect sensor.

Rubidium vapor magnetometer similar to the one flown in the Explorer X package is planned for Ranger I and II planetary spacecraft development flights. Backup payload for the Explorer X, which has the designation P-14, is available but no decision has been made on another flight.

Power for the electronics was provided by an 18-watt pack of 174 nonmagnetic silver zinc batteries developed by Yardney Electric Corp.

France, U.S. Agree On Common Space Plan

Paris—U. S. and French space officials are agreed in principle on a common space program under which French instrumentation will be launched by U. S. rockets.

Four-point agreement between French officials and NASA was signed in Washington. The French were represented by Andre Piganiol, in charge of French scientific research, and Pierre Auger, president, French space committee. The agreement outlines a four-step program as follows:

French space committee will shortly submit to NASA a detailed program covering experiments in very low wave frequencies, luminosity levels and certain biological reactions—notably brainwave and muscle tone—relative to space flight. Instrumentation for such experiments will be built by the French space committee and installed, with NASA cooperation, in NASA sounding rockets, probably the Chance Vought-NASA Scout.

Second point of the agreement stipulates that if the rocket-sounding experiments are satisfactory to both sides, then additional space experiments will be undertaken using a U. S. satellite to carry French instrument payloads.

Third point covers technical assistance which will be given by NASA toward establishment of a French rocket launching site. Presumably, it will be from this site—which will not be located in the Sahara—that the Scout shots will be made.

Fourth and final point of the U.S.-French agreement covers exchange of information and technicians. The French, for example, expect shortly to send an initial group of engineers to the United States to work at NASA test centers.

Each country will finance its own part in the common program, and no funds will be transferred from one side to the other. No cost figures were given, however. French sources predicted the first Franco-U. S. satellite would go aloft within two years.

Borgward May Cancel Kolibri I Development

Bremen—Financial difficulties are threatening the future of West Germany's first post-war helicopter, the three-seat Kolibri I developed by automobile manufacturer Carl F. W. Borgward GmbH.

Decision as to whether to continue the project or cancel it completely is expected by late April or early May.

Construction of the first prototype was begun in 1957 and flight trials got under way in early 1959 (AW June 15, 1959, p. 105). Thus far, only two prototypes have been completed.

A Borgward spokesman said last week that the question of further development of the Kolibri is one of a number of decisions now under consideration by the board of directors following the firm's reorganization earlier this year.

720s Grounded For Generator Fix

American Airlines and Lufthansa German Airlines grounded their Boeing 720 fleets briefly last week to replace a new a.c. generator component that was interrupting the flow of power to flight and engine instruments on the aircraft.

The component, a silicon diode rectifier built by Westinghouse, converts a small amount of alternating current output into direct current to excite magnetic fields within the alternators. Largely because Federal Aviation Agency had decreed that the four 720 alternators must be wired in parallel, malfunctioning of the diode resulted in a major power loss.

To remedy the problem, American and Lufthansa are installing improved diodes and linking the number four engine alternator to an essential power distribution point, thus isolating it from the other three a.c. generators. Meanwhile, Westinghouse's Aerospace Equipment Department has sent five engineers to the Boeing plant at Renton, Wash., to find out what caused the diode failures.

USAF to Fund New ICBM Warning System

Highly sensitive orbit-go-around surveillance system using infrared and ultraviolet sensing for detection of hostile ballistic missiles during their boost phase is being advanced by the Air Force in an industry competition under Project Lofter.

Five 5-month system-study contracts are expected to be awarded soon from proposals under evaluation. First reports under the system studies will be presented to the Air Force two-and-a-half months after contract awards, indicating a relatively high priority for the project. From the five contenders, a single contractor will be chosen to develop the required detection system hardware under the research and development phase.

Implemented under Advanced Research Projects Agency order number 162-61, Lofter may be developed as an independent satellite system or might possibly bring results which may be cranked into Project Bambi, under which proposals now are being evaluated for a ballistic missile boost intercept system incorporating both detection and destruction capabilities.

Project Lofter parallels Project Midas—Air Research and Development Command Ballistic Missile Division's missile defense alarm infrared system now in its early development stage—but intends to extend Midas capability by both infrared and ultraviolet refined techniques for much greater detection sensitivity, even to the extent of sensing from orbit, under adverse conditions, the exhaust blast from booster engines developing less than 100,000 lb. thrust. (Air Force Douglas Thor IRBM engine develops about 150,000 lb. thrust.)

This capability of Lofter could accommodate detection of hostile IRBM launchings from nuclear-powered submarines similar to the Polaris-carrying type, or firings from railway cars or trucks of mobile, lightweight ICBMs which, anticipating state-of-the art acceleration, might require relatively low thrust to boost very light, very high yield nuclear warheads.

Briefings for Project Lofter were held in mid-January at Wright Air Development Division. Three sessions covered component development; a fourth covered over-all system requirements and was presented by a representative of the Ballistic Missile Division, which will have management responsibility for the project, apparently to be conducted as a BMD/WADD inter-divisional effort.

More than 50 companies, all with some experience in the field of infrared research and development, were represented at the briefings by a total of more than 150 scientists, engineers, or technicians. Apparently these industry segments will have access to a report being prepared by the University of Michigan, under contract from the Air Force, collating all infrared data available.

Infrared component development for Project Lofter will have to be within the state-of-the-art, with total weight for infrared equipment not to exceed 200 lb. This state-of-the-art requirement does not necessarily mean that existing components will have to be used, because the development phase undoubtedly will anticipate refinements reasonably in keeping with what would then be "present-day" capabilities.

Research and development phase firings for Project Lofter are scheduled to be made over the Pacific Missile Range in a north-south direction from Vandenberg AFB or perhaps from Air Force pads on Navy's Pt. Arguello facility. Assembly of prototype equipment may be accomplished at Edwards AFB as one alternative.

Fundamental concept underlying missile exhaust flame sensing from space is that in any detection system, if there is not a moving target indication, signal returns are wanted in the several bands of the electromagnetic spectrum, each band having its particular noise as well as in the atmosphere's "windows." The characteristic frequency produces its own response in a medium. On any specific day, atmosphere and space conditions could be conducive for infrared signals to get through, whereas on another day ultraviolet signals might be detected. Scientists feel that the possibility exists to operate mathematically off the two types of returns to increase the probability of detection. Both military planners and industry researchers have for sometime anticipated the stepped-up need for improved detection techniques. Individual studies have been, and are now being, conducted under funded contracts from the military and with company funds.

Ultraviolet scanning is an area of keen interest in experiments anticipated for future orbiting observatories to add to the fund of relatively meager knowledge in spectral phenomena.

Design of ultraviolet visible photometers to sense and measure radiated energy from missile exhaust at launching has been under consideration, as well as similar equipment to spot a missile during the re-entry phase.

The effect of space environment on ultraviolet and infrared sensing equipment will be a factor in efficiency of detection, and the Air Force is projecting research in this area to pinpoint environmental effects at altitudes up to approximately 25,000 mi.

At least two industry companies have been intensively pushing research leading to development of precision infrared tracking systems.

Mercury-Redstone Tests Changes

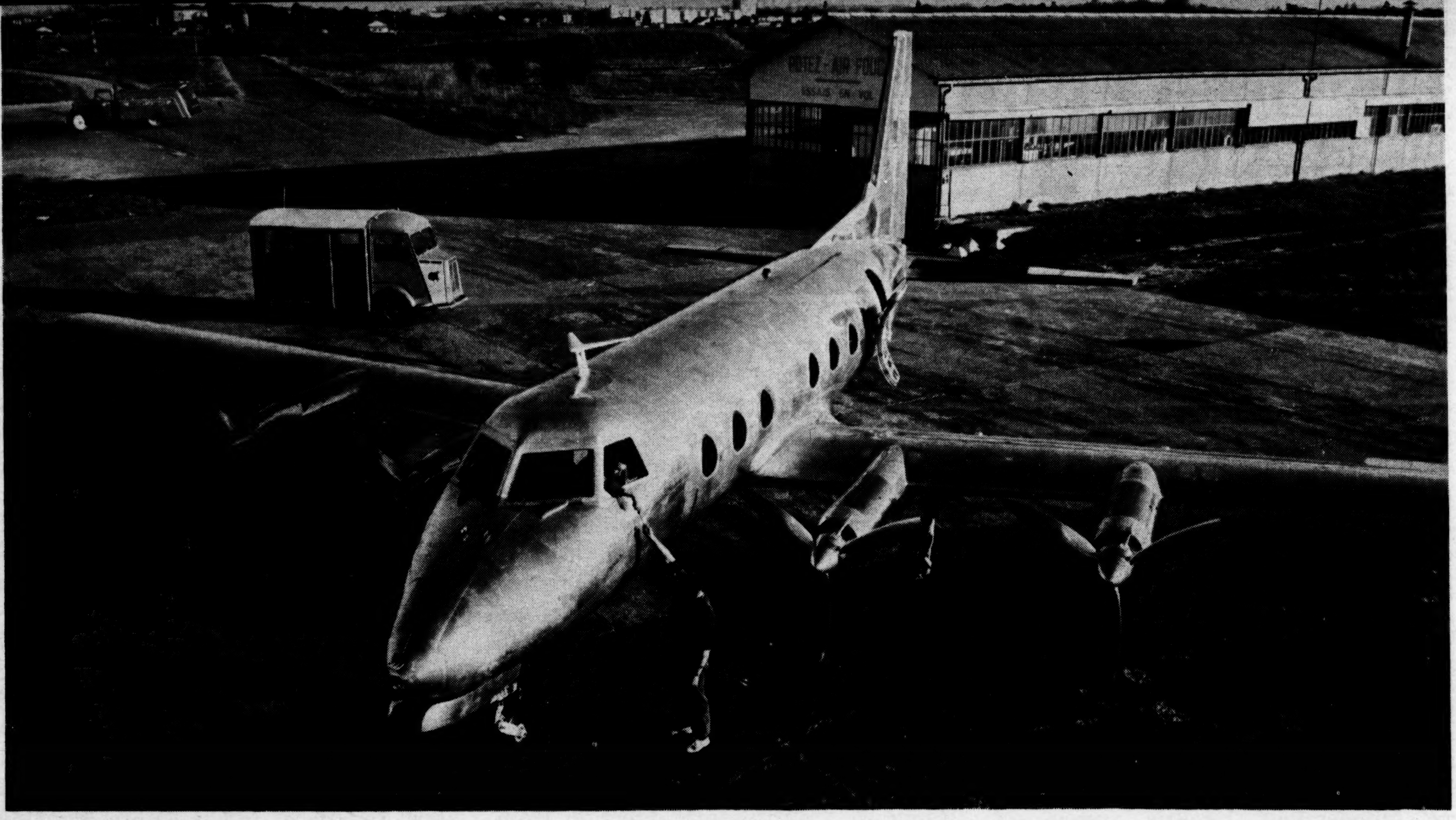
Washington — Mercury - Redstone booster system has successfully flown an evaluation profile, testing anti-vibration modifications and completing one of the two development flights considered necessary before a manned ballistic flight can be attempted.

Final flight before manned launch will be the seventh Little Joe test of performance of the McDonnell Aircraft Corp. capsule and escape system during an abort at maximum dynamic pressure (AW Mar. 27, p. 30). If the Little Joe launch, to be made by mid-April, is successful, the manned Redstone flight could be attempted during the following four weeks.

Third Mercury-Atlas flight may be made before the manned Redstone flight, but its outcome probably will not affect the Redstone schedule. The next Atlas flight will be an injection abort trajectory, in which an instrumented capsule will be flown on a tangent with the orbital path but will not go into orbit (AW Feb. 27, p. 26).

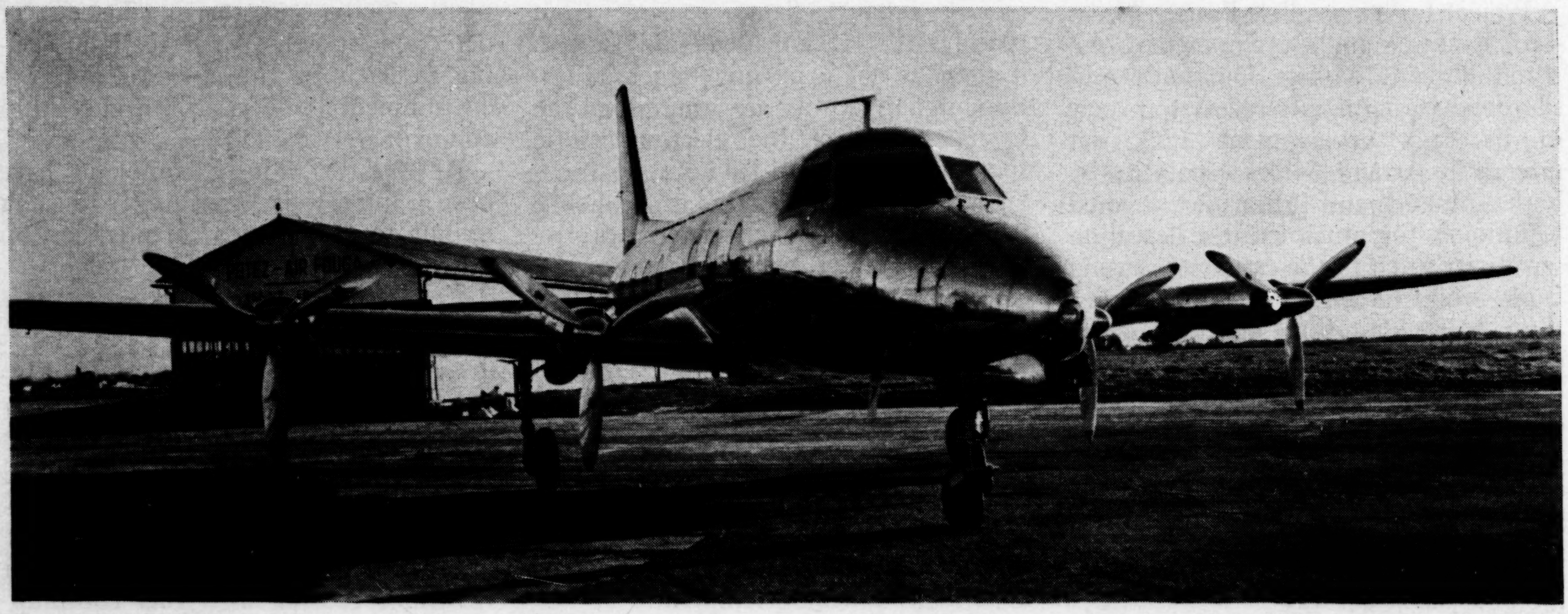
In the Redstone booster development flight Mar. 24, an electrical filter was installed in the attitude control system to damp out signals caused by vibrations. Analysis of the second Mercury-Redstone test showed that the throttle apparently jammed open from vibrations causing high fuel consumption and inadvertent operation of the escape system. In addition to use of the filter, the inner skin of the Redstone instrument compartment was covered with a vibration-reducing undercoating.

Severe tilt angles were programed into the automatic control system, and the controls effectively compensated for the errors. There was no booster-capsule separation, since the flight was aimed at booster evaluation, and the system landed about 0.5 mi. from the target point. Profile was essentially the same as planned on all subsequent Redstone flights: apogee was 115 mi. and range 311 mi. Maximum velocity was 5,110 mph. Rocket performance was telemetered from 65 points within the launch vehicle.

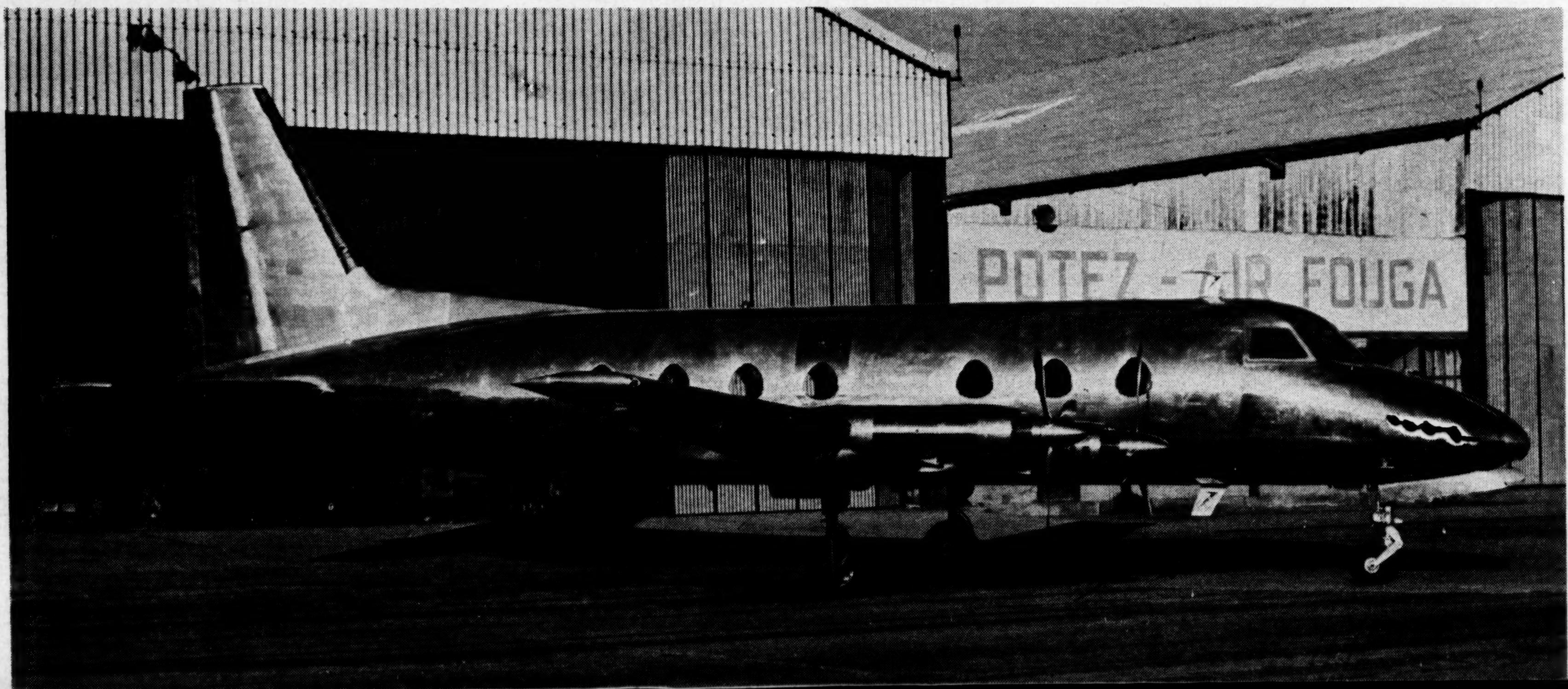


French Potez-Air Fouga P.840 is designed to carry from 16-24 passengers. Second prototype is currently being fabricated by Potez at its Argenteuil (Paris) factory. Plane is scheduled to be shown at the 24th International Air Show, Le Bourget, May 26-June 4.

Potez-Air Fouga P.840 Transport Readied for First Flight



Gross weight of P.840 light transport is 16,750 lb. Plane, being prepared for first flight at Toulouse, is powered by four Turbomeca Astazou II turboprops delivering 530 hp. each, and can carry a 5,300-lb. payload at 300 mph. cruise speed (AW Feb. 29, 1960, p. 50).



Russians Deny Killing Pilots in Space Failures

Moscow—Soviet scientists denied emphatically last week that any Russian astronauts have been killed in unsuccessful attempts to put them into orbit. They said the first human into space will be a Russian male, and hinted he will go alone—not with a "copilot," as Western scientists have speculated.

Speaking at a press conference on the second successful orbital flight and recovery of dog-carrying satellites in 16 days, Alexander Topchiev, vice president of the USSR Academy of Sciences, said Western reports of fatal launch attempts were "utter fabrications, entirely and absolutely unfounded."

Another scientist indicated the first manned Russian spacecraft will carry only one passenger, although the model now apparently in proof testing weighs about five tons. "There will be a great deal of work for him to do," the scientists said. "There will be a control panel. He won't have time for conversation or card-playing."

Topchiev said the first manned flight will be orbital. "We don't particularly consider vertical or ballistic flight [to be] interesting—or even [to be] spaceflight, in the true sense," he said.

On Mar. 25, Russia sent the 10,352 lb. Sputnik X, or Spaceship V, into an orbit having a 153.49-mi. apogee, a 111.67-mi. perigee, an orbital period of 88.423 min. and an inclination to the equator of 64 deg. 54 min. It was successfully recovered on ground command after "several revolutions," and landed at a predetermined spot, the Russians said.

It carried a 13-lb. spotted brown female dog named Zvezdochka, plus mice, guinea pigs, frogs, microbes, viruses, fungi, dry seeds, onion shoots and other organisms and a solution of desoxyribonucleic acid and various ferments.

Biologist Norair Sisakyan and V. Parin, member of the Academy of Medical Sciences, and others said space dogs have developed "highly refined" changes in nuclear structure of cells, but said there is no evidence yet of adverse effect on physiological functions. Examination of bone marrow of mice sent into orbit shows that a number of blood cells do not reproduce normally, but it is not yet possible to say whether the blood-forming function of marrow is impaired, they said.

Dry onion and Nigella seeds, planted after a day's flight in the satellite launched last August, sprouted earlier than control seeds used for comparison, Sisakyan said. Viability of a radiation-sensitive strain of the Ray Fungus-8594, in terms of the number of surviving spores and developed colonies, was found to be reduced 12 times compared

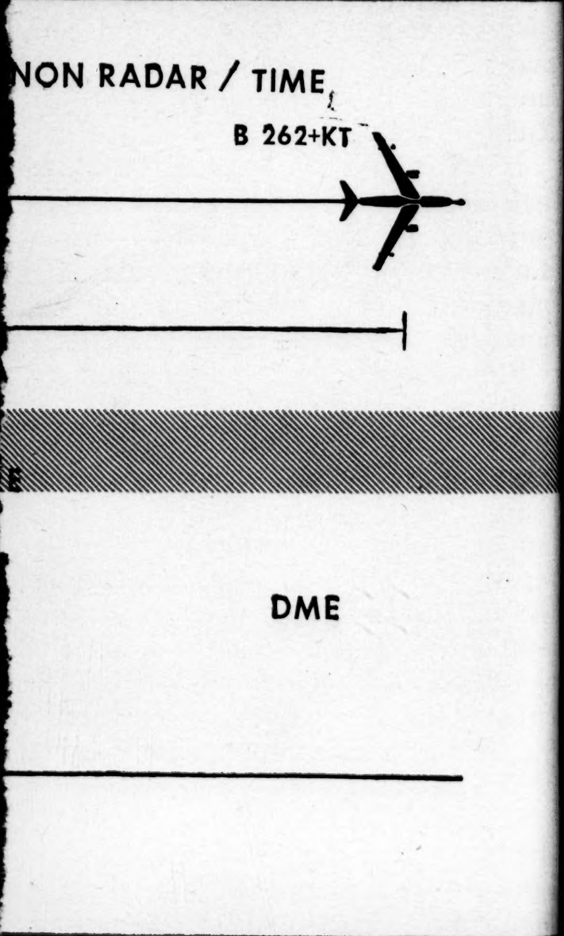
Traffic Contro

longitudinal limits of a holding pattern.

- **Easing the problems** involved in circumnavigating areas crowded with conflicting traffic and facilitating en route altitude changes.
- **Offering continuous position** fixes to pilots following a given course, along with additional and accurate approach information.
- **Helping to eliminate** holding points formed by the intersection of visual omnirange radials.

To illustrate how DME might reduce cockpit workload, Thomas pointed out that a pilot often must retune radios and cross-check stations to pinpoint his position for traffic controllers. Thus his attention is diverted from the main task of operating the aircraft. At the same ime, information relayed to the controller is of limited value because it is keyed to radio bearings and not easily convertible to time or distance units.

Reception of VOR stations being used for course guidance may be interrupted by this process, Thomas said. Nevertheless, controllers must ask for such position reports in order to establish safe separation between aircraft,



E, departing on identical flight paths, is com-
%.

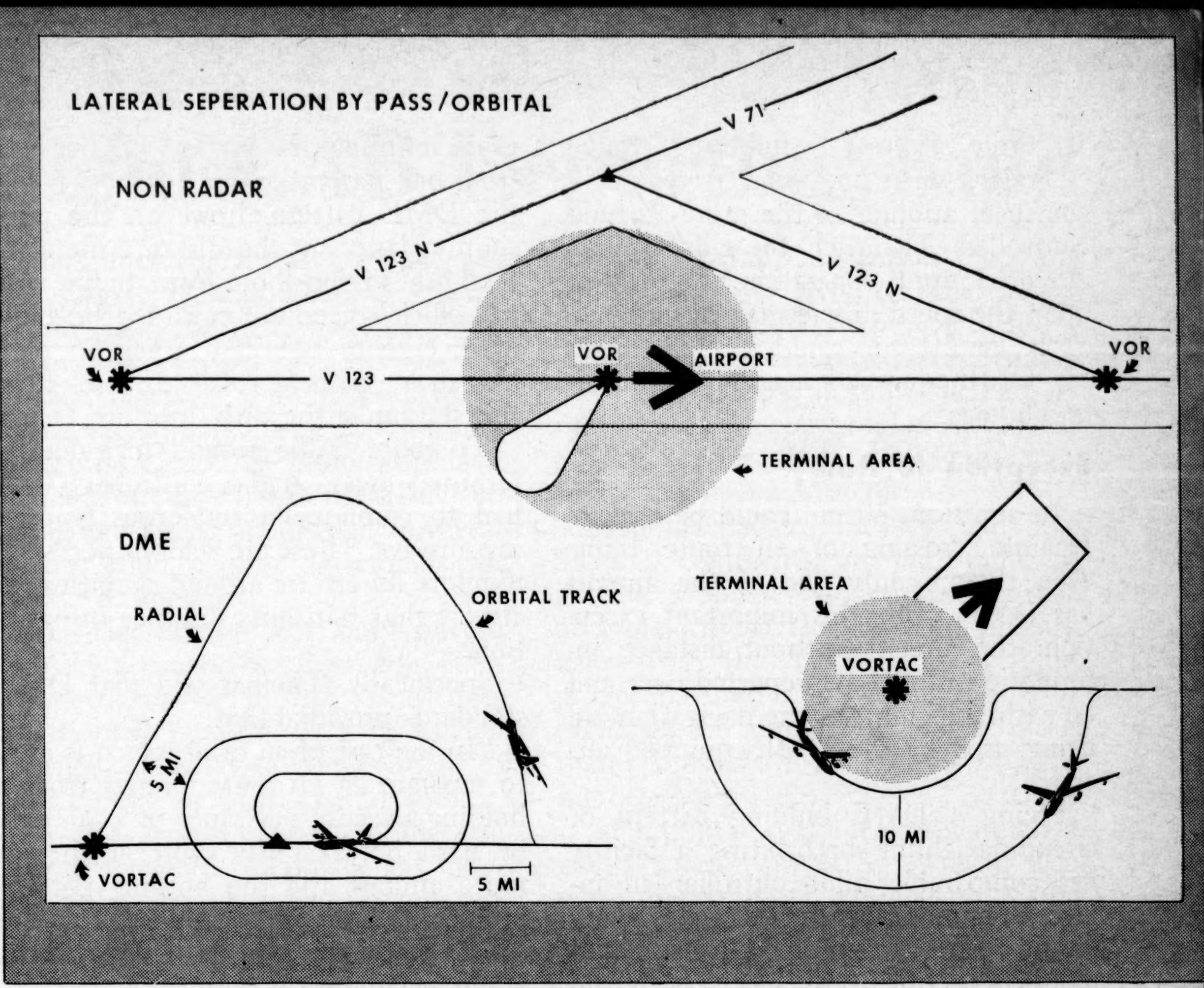
Bottlenecks

and they must receive the information quickly.

Miles to or from any VORTAC or TACAN station are on continuous display before the pilot flying a DME-equipped aircraft. Therefore, Thomas said, the pilot's reply to a position request can be almost instantaneous. "It may not require any equipment tuning or appreciably detract from other duties; in addition to facilitating navigation problems, DME assists him in complying with the demands of safety as we all know them."

Thomas began a specific comparison of separation minimums for aircraft with DME and aircraft without DME by discussing two transports departing from an airport to follow the same route at the same altitude. Lacking DME, one pair of transports could take off 5 min. apart, in the absence of radar, if the first aircraft had an airspeed at least 22 kt. faster than the second. Assuming speeds of 262 and 240 kt., respectively, 20 mi. would be used to establish separation.

Comparable separation between the same aircraft, if DME-equipped, could be 10 mi. As a result, some airports—where the flow of traffic is customarily stalled by marginal weather—could dispatch aircraft at twice their present rate through broad use of DME.



AIRCRAFT forced to bypass high density traffic areas or holding patterns would save time with DME by flying orbital courses at a given distance from the station.

Examining the en route situation above 24,000 ft. along the continental network of jet airways, Thomas said that even greater reductions in the airspace required for traffic separation were possible. Within the high altitude airway structure, basic separation for two aircraft flying the same route and altitude is 10 min. At 480 kt., this equals 80 mi.

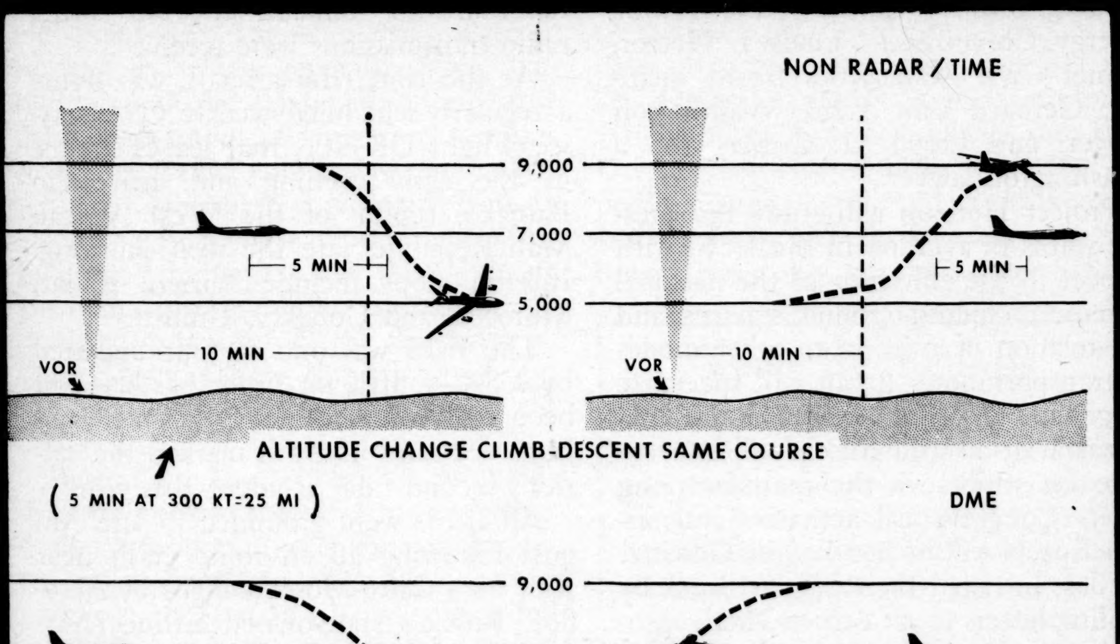
"Use of minimum DME separation between the same two aircraft," Thomas said, "could result in a minimum of 20 mi. separation, or only 25% of the distance that might result from application of the time separation standard."

When one of two aircraft flying the same airway wishes to change altitude, air traffic control now must ascertain that the pair is at least 5 min. apart. With DME, however, a 10-naut.-mi. separation can be used to climb the succeeding aircraft to or through the altitude of the preceding aircraft, or descend the preceding aircraft to or through the altitude of the one behind it.

Thomas qualified this rule, pointing out that if the two transports wind up flying at the same altitude, there must be a speed differential to ensure that minimum en route separation is maintained.

In addition, he said, the 5-min. time separation currently can be applied only to climbing or descending aircraft when the second aircraft is within 10 min. of a fix over which both have reported. DME separation, by contrast, can be applied anywhere en route.

As to the impact of this provision, a pilot with DME and 10-mi. separation can change altitude immediately; the pilot without it must wait 10 min.,



DME-EQUIPPED aircraft can climb or descend through occupied altitudes 10 mi. from conflicting traffic. Standard time separation would more than double this distance.

if there is any conflicting traffic.

Today, when one aircraft crosses the course of another at the same altitude, controllers guarantee the pilots either 10- or 15-min. separation. Depending upon the speed differential, distances of 5, 10 or 20 mi. could be substituted for DME-equipped aircraft, according to Thomas.

Exception to Rule

In addition, 30 mi. could be used to separate crossing or en route traffic even though only one of the aircraft has DME, with this important exception: the aircraft without distance information must have reported over and be within 15 min. of the navigation aid being used by the DME-equipped aircraft.

Flying a DME holding pattern or circumnavigating or orbiting a facility has comparable pilot-controller advantages, Thomas said. For example, many holding patterns currently in use entail monitoring two VOR receivers or the rapid retuning of a single VOR receiver from one navigation aid to another. In the DME pattern, however, the pilot simply glances at the distance meter to establish his position. And traffic control officials need not consider the angle of divergence between radials in plotting such a pattern, for its distance from the station is the only limiting factor.

To route traffic around high-density terminal areas, traffic controllers have had to commission numerous by-passing airways. These are seldom necessary if pilots fly an arc around a station or airport that transmits distance information.

Specifically, Thomas said that DME standards provided that:

"In the case of an orbit which is used to separate an en route aircraft from a holding aircraft, a distance of 5 mi. may be used between the orbit of the en route aircraft and the holding pattern protected airspace occupied by the other. Between two orbiting aircraft, 10-mi. separation is required."

Task Forces to Report by July 1

Washington—Staffs of President Kennedy's two aviation task forces, Project Horizon and Project Beacon, were completed last week with plans to expedite the over-all program so that all technical, economic and military studies will be completed within 90 days.

Project Horizon will investigate the development of military, commercial and general aviation during the next decade and recommend national aviation goals which should be set for 1970. Project Beacon will study air traffic control and recommend a system for safe and efficient use of airspace.

Fred M. Glass will head Project Horizon, with Stanley Gewirtz as vice chairman (AW Mar. 27, p. 21). Other members of the task force are Dr. Leslie A. Bryan, University of Illinois; Gerald A. Busch, on leave from Lockheed Aircraft Corp.; and Paul Reiber, Washington lawyer.

Richard R. Hough, Ohio Bell Telephone Co., is chairman of Project Beacon. Other members, on leave from their organizations, include Harry B. Combs, president of Combs Aircraft Co.; George C. Comstock, Airborne Instrument Laboratory; James F. Digby, Rand Corp.; William Littlewood, American Airlines; Russell C. Newhouse, Bell Telephone Laboratories, and Nathaniel Rochester, International Business Machines Corp.

Project Horizon will be supported by a special, part-time scientific advisory group which is being organized to review U. S. aviation facilities and related research and development programs. Dr. Jerome B. Wiesner, the President's science adviser, has named Dr. Jerold Zacharias of Massachusetts Institute of Technology to head the special group. Other members include Arthur E. Raymond, Rand Corp.; Frederick R. Lack, Western Electric Co.; and Dr. Emanuel Piore, International Business Machines.

A special consultant group has been organized to advise Project Horizon on rule-making and enforcement procedures. This group consists of John F. Floberg, former member of the Atomic Energy Commission; Louis J. Hector, former Civil Aeronautics Board member; Gerhard Van Arkel, Washington lawyer; and Lloyd M. Cutler, also a Washington lawyer.

Project Horizon will study the present status of aviation in the U. S. with respect to the efficiency of the national system, including ground services and the relation of aviation to other modes of transportation. Bryan will specialize in general aviation, Reiber in international aviation and Busch will concentrate on studies in the manufacturing areas. Congressional activities and airline aspects will be handled by Gewirtz.

Glass initiated the study last week by mailing letters to air carriers, trade associations and unions associated with aviation seeking views from a wide spectrum of the industry on what aviation goals should be. Groups contacted have been asked to designate specific advisers to form another group augmenting the two task forces. Professional consultants will also be used in the development of a program.

The two task forces, created independently, will work closely together, but separate reports on findings will be submitted to the President before July 1.

Czechoslovak Il-18 Crashes in Bavaria

Geneva—Czechoslovak Airlines Soviet-built Il-18 turboprop transport crashed and exploded in a Bavarian field last week 30 min. after takeoff from Prague on the first leg of a scheduled flight to West Africa. The accident at least outwardly resembled an earlier one last summer that resulted in a two-month grounding of the aircraft.

The Il-18, flying a scheduled 1 hr., 10-min. leg to Zurich, went into a shallow dive, crashed into a field and exploded as its crew appeared to be attempting an emergency landing near the Bavarian village of Forchheim, approximately 19 mi. from Nuremberg and 150 air mi. from Prague.

Eyewitnesses seemed to agree that the aircraft was on fire prior to impact, although there was some dispute as to the exact place. Some said that at least one engine was on fire, others that flames were "trailing" from beneath the aircraft's fuselage as it flew at low altitude over the hamlet of Grafenberg.

All 44 passengers and eight crewmembers aboard the aircraft were killed. Weather conditions at the time of the crash were described as "excellent."

Pilot of the aircraft, which had the registration number OK-OAD made a routine radio check over Bayreuth, Germany, only five minutes before the crash and three minutes before the plane went into its shallow dive but reported no difficulties. No other radio transmissions were received.

At the time, the aircraft was flying a regularly-scheduled weekly CSA service, Flight OK 511, that leaves Prague in the early evening and arrives in Bamako, capital of the West African Mali Republic, late the next morning. Interim stops include Zurich; Rabat, Morocco, and Conakry, Guinea.

The Il-18 was one of four operated by CSA—a fifth on order has not yet been delivered, airline spokesmen said last week—and its crash marked the carrier's second fatal accident this year.

All Il-18s were grounded in late August following an en route crash near Kiev on a Cairo-Moscow flight by Aeroflot, Russia's state-owned airline (AW Aug. 29, p. 45). The Il-18s of Aeroflot and other airlines were then returned to Moscow for modifications, and CSA began placing its fleet back into service in late October (AW Oct. 24, p. 39).

While the aircraft were still grounded, E. R. Quesada, then administrator of the Federal Aviation Agency, said after a visit to the Soviet Union that the grounding stemmed from engine fuel injection failures that resulted in burned out combustion chambers (AW Oct. 10, p. 37).

Foreign Lines Fight CAB Reporting Rule

Washington—Foreign airlines are presenting a solid front against a Civil Aeronautics Board investigation which they fear will counteract a major advantage of existing bilaterial agreements and lead to a reduction in their share of the U.S. traffic market.

Board proposals that foreign air carrier permits be amended to require detailed reporting of traffic figures, schedules and pooling agreements which might affect the foreign flag transportation of U.S. traffic have been termed illegal by 21 airlines. These carriers say such a rule would violate bilaterals and sections of the Federal Aviation Act requiring CAB to honor any contract or agreement in effect between the U.S. and a foreign government. They also say adoption of the proposals would give the Board "unlimited day to day control" over foreign carrier operations.

Implicit in many of the objections was the fear that CAB, in an attempt to battle the inroads of foreign airline competition, might use the required traffic and schedule information to spark a full-scale congressional investigation of the competitive problem. In view of the strong U. S. emphasis on anti-trust prosecutions, it is also likely that detailed disclosure of foreign pooling arrangements could result in separate congressional hearings.

CAB left no doubt that its proposals are designed to attack the capacity and frequency problem at its most vulnerable point—the vagueness of bilateral agreements which generally agree that traffic should be related to supply and demand—without setting any limitations on traffic volume. Armed with sufficient statistics, the Board feels it would be in a more practical position to judge whether or not the bilaterals are being interpreted to the advantage or disadvantage of U. S. flag carriers.

India is the only country which exchanges traffic figures with the U. S. under a current bilateral agreement.

Basically, the Board's proposals would eliminate the need for any other traffic information exchange under bilaterals by requiring all foreign carriers to report traffic data whenever required by CAB as a major condition for granting or renewing foreign air carrier permits. Advance notice of any future schedule increases, plus the addition of airports not usually served on the schedules, would also be subject to Board approval. Airlines would be given a 20-day period in which to withdraw the added service after CAB rejection.

On the basis of a motion by Pan American World Airways, the Board is also planning to include the reporting of all foreign airline pooling agreements and has directed British Overseas Airways Corp., Qantas Empire Airways and Air-India International to reply to this motion by Apr. 12.

Pan American contended that requiring the submission of this information would give CAB more latitude to act where foreign carriers abuse their operating privileges, in addition to revealing any other pooling agreements not known to the Board.

Such agreements not only have a "marked competitive effect" on U. S. airlines operating in the same areas, said PanAm, but can often be used to "obscure the freedom composition" of traffic carried by individual airlines.

Pan American's philosophy undoubtedly reflects the position it shares with Trans World Airlines on its service to India over routes competitive with the BOAC-Qantas-Air-India pool. Under the current bilateral, which permits India to limit U. S. flight frequencies into its cities, Pan American and TWA combined have only six flights a week, compared with the 21 frequencies permitted BOAC and Qantas under the pooling agreement.

Basis for this distribution is the current exchange of traffic data between the U. S. and India, with the Indian government interpreting en route stopover American travelers as Fifth Freedom traffic sufficient to justify a limitation on U. S. frequencies into India.

Aggravating this competitive problem is the fact that Air-India, along with its pooling partners, is operating Boeing 707-420 jet equipment and has no limitations on its flight frequencies into the U. S. Competition from this type of pooling might be further intensified, if India gains a Moscow-London route in negotiations this year with the Soviet Union. Air-India also has a pooling agreement with Aeroflot, the Soviet airline, and could be expected to use it further on a Delhi-Moscow-London-New York routing if India succeeds in adding the Moscow-London link to its present twice-a-week frequency between Delhi and Moscow.

Scandinavian Airlines System and Swissair comments on the traffic reporting proposal typified the position of a majority of the objecting airlines, who view the CAB idea as more properly a matter to be handled by an exchange of diplomatic notes rather than a proviso attached to their operating certificates.

Maintaining that current bilaterals in effect between the U.S., Sweden, Denmark and Norway contain no restrictions on schedule frequency on traffic capacity, SAS said that clauses covering these problems in the agreements have always been interpreted more as a principle than as a definite condition of their operations. President Truman several years ago hailed this interpretation as giving the airlines "an opportunity to use their own initiative and enterprise," the airline said.

Contending that CAB has no legal authority to implement its proposals, but is required to observe all parts of bilateral agreements in accordance with the Federal Aviation Act, SAS charged that the Board's proposals are "but one arm by which the CAB proposes to regulate capacity . . . approval of schedules is the other."

Swissair took a similar stand and expressed the added concern that there is nothing in the CAB proposal to prevent the transfer of the requested information to Congress. This information has been given in the past to governments conducting bilateral negotiations and to the International Civil Aviation Organization, with the understanding that it would be confidential, the airline said.

"We do not say the United States is not entitled to seek this information," said Swissair, "but it is not authorized to broadcast it throughout the world."

Lufthansa supported its protests against the CAB proposal by pointing out that the German Ministry of Transport made no attempt to regulate Pan American schedules between New York and Frankfurt after attempts to alter the frequencies by diplomatic talks failed. Pan American has not changed these schedules, which are directly competitive with Lufthansa, the German carrier said, and attempts to change the situation are still being conducted under bilateral procedures instread of through any direct action by the Ministry of Transport.

Fare Reductions

New fare structure for Latin America agreed upon by International Air Transport Assn. members at a recent conference in Bermuda (AW Mar. 27, p. 48) includes economy round-trip rates at considerable reduction.

Examples of new fares expected to become effective May 15 are New York-Buenos Aires, $599 compared with present tourist fare of $934; New York-Rio de Janeiro, $594 compared with $790.20; and New York-Montevideo, $599 compared with $919. Lower fares also were set from the U. S. and Canada to Bermuda, the Bahamas and the Caribbean, and a special New York-Bermuda excursion fare of $134 first class and $95 economy. A special family plan fare also is to go into effect for Bermuda traffic.

LOS ANGELES AIRWAYS' S-62 touches down on ramp at Los Angeles International Airport on a scheduled flight from San Bernardino, Calif. Landing area is between terminal fingers of American Airlines and Trans World Airlines.

S-62 Utilized for Turbine Familiarization

By William H. Gregory

Los Angeles—First U. S. turbine helicopter in scheduled service—a single Sikorsky S-62 leased by Los Angeles Airways from the manufacturer—has produced a 5-6 hr. daily utilization record on a five-day-a-week schedule.

The operation has produced some initial break-in problems, but little down time has resulted in the operating schedule itself. Frequent modifications required by service bulletins for an engine new in service were the biggest early maintenance problems, but for the most part these and other major maintenance operations have been accomplished on weekends when the aircraft normally is not in service.

One scheduled flight was canceled because of an in-service problem. This was an O-ring leak in the No. 2 bearing scavenge line flange of the engine. Three days were lost out of the S-62 schedule in January because of a mid-period engine hot section inspection and change of the main gearbox from the S-62-35-20,000-2 to the -3.

In-service problems caused two delays in schedules that did not result in cancellations, according to Robert L. Bromberger, manager of flight operations. One resulted from locating an oil leak, traced to a carbon seal on the input shaft to the transmission. The seal has since been redesigned from a flat surface to a shouldered design. An auxiliary switch malfunction in the flight control servo system was the other cause of delay.

There was one case of erratic operation of the engine overspeed governor amplifier, but this was noted during preflight test and was rectified the same morning.

One case of power loss during a scheduled flight occurred shortly after engine removal, but the incident was not considered an engine failure by the airline.

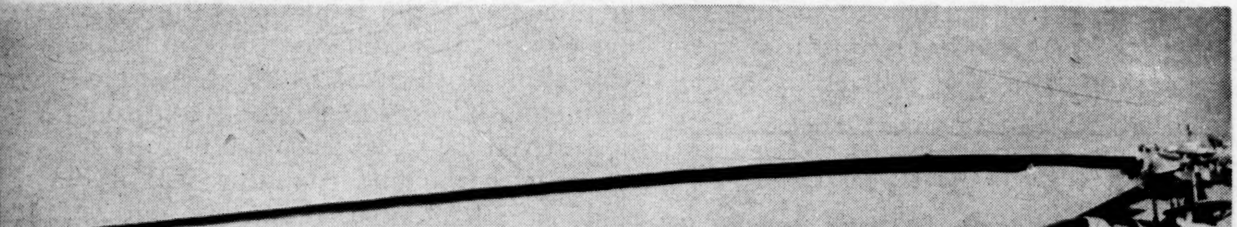
During approach to the ramp at the Los Angeles Airport, at an altitude of 150-200 ft., the engine flamed out. Since the throttle was at idle, the pilot did not notice the stoppage from lack of noise, but only when the exhaust gas temperature began to fall. Since the helicopter was in near autorotative attitude, the pilot simply completed the landing in autorotation.

With a GE technical representative on board, the engine stoppage was reproduced in a training flight by pulling up abruptly on the collective pitch to initiate a climb, then abruptly reversing the attitude by slamming down the collective and pulling the throttle to full idle. The test was designed as part of a training autorotative landing, and the landing was then completed at the airport. The condition also was reproduced in training on takeoff, using the same technique, but before the ship had cleared the ground very far.

Trouble was pinned on adjustment of the fuel control during the engine inspection, and the control has since been set up to ensure fuel flow in all flight regimes.

Though Los Angeles Airways makes it clear the S-62 does not fit in its permanent equipment plans, it feels the leased aircraft has justified itself in familiarization with the engine that is to power its five Sikorsky S-61Ls on order and in turbine operation characteristics generally. Biggest S-62 drawback for Los Angeles Airways is its lack of mail, cargo and baggage capacity.

The ship was delivered in October and was operated for two months on



ONE of the S-55s operated by Los Angeles Airways frames the airline's leased S-62, which is parked between flights at the gate area.

PASSENGERS disembark from the S-62 after it is taxied to Los Angeles Airways gate area. Configuration provides seating for nine passengers.

a 100-hr. proving schedule with Los Angeles Airways and Federal Aviation Agency personnel. All 18 company pilots now are checked out in the aircraft on a syllabus that called for about 5 hr. concentrated flight training and another 10-15 hr. actual operation on routes.

Five flights are operated daily. Two are to Disneyland and return in the morning, an 18-min. one-way trip; two to San Bernardino in the afternoon, a 45-min. trip one way, and one more to Disneyland in late afternoon. Increased utilization is planned as frequencies are added with the airline's emphasis on increased passenger carrying.

Fuel consumption of the General Electric CT58-100-1 free turbine engine has averaged 58 gph. but the airline has been carrying enough fuel to meet FAA's 20-min. fuel reserve minimum based on a 70-gph. consumption. This is normally less than half its 187-gal. capacity.

The aircraft has been operating up to full certified gross weight of 7,500 lb. and useful load of 2,200 lb. Normal cruising altitude in the Los Angeles area for all Los Angeles Airways flights is 1,500 ft., and S-62 normal cruising speed is 95 kt.

Flight minimums for the airline's S-55s are followed by the S-62, and pilots have found the handling characteristics much the same as the S-55. The S-62 has the same dynamic components for the most part.

Cabin configuration is three forward-facing seats at the rear, a bank of four seats paired back to back at the center of the cabin, and two more seats forward mounted longitudinally opposite the baggage compartment. Except for training, one pilot operates the ship. Ground handling equipment, including start cart, is the same as for S-55.

Service bulletin modifications were greatest for the engine during its first 300 hr., and since have tapered off more into refinements. These resulted in three engine removals during the proving run period for compliance.

Besides the hot section inspection removal, there was one other removal after start of scheduled service. This was for fuel manifold inspection in accordance with bulletin requirements.

Hot Section Inspection

General Electric has been handling hot section inspection and modification at its Ontario, Calif., plant. It will continue to perform overhauls after Los Angeles Airways acquires its S-61Ls, but the airline plans to take over hot section inspection eventually.

The engine, the commercial version of the military T58-6, is derated to 730 shp. for takeoff and 671 shp. for cruise to match with the gearbox. It was installed by Sikorsky prior to delivery to Los Angeles Airways and at the time of transfer had total time of 57 hr. 48 min. since new. As of mid-March, the engine had 516 hr. total time and had not yet reached the first 600 hr. overhaul period specified by FAA for air carrier operation.

Overhaul period on the gearbox is now only 300 hr. for air carrier operation, but Sikorsky is supplying data for seeking FAA approval for increasing the interval. Engine removal is necessary for gearbox overhaul, but Los Angeles Airways maintenance people do not consider this a major problem at present.

The S-62's current -3 version of the gearbox has run 224 hr., or less than the time required for first overhaul. The -3 gearbox has an input reduction gear modified from the -2 version for higher output at the same engine speed and has nine instead of eight planetary gears in the secondary stage, making for better gear life.

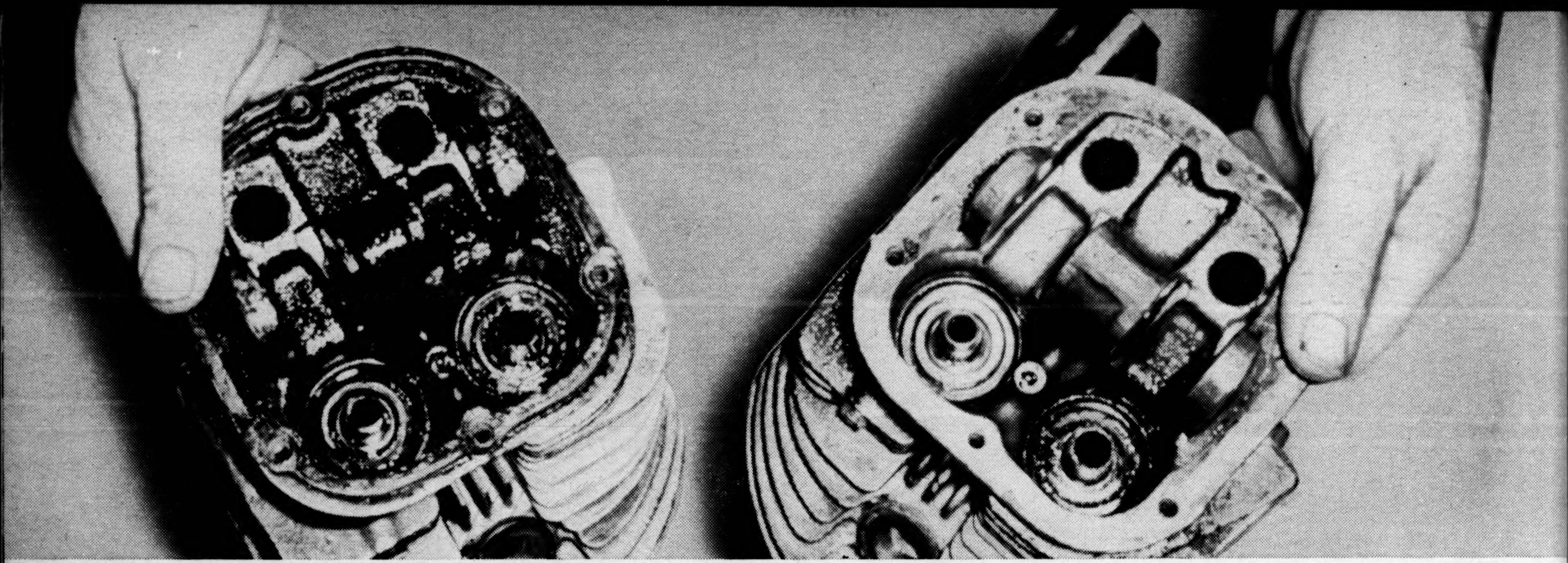
Los Angeles Airways does main and tail rotor gearbox and rotor head overhaul and periodic airframe inspections.

So far the airframe, with 800 hr. time, has shown a better trend than that of the company's S-55s. The latter have magnesium skin that is more sensitive to corrosion than the S-62's aluminum skin.

Maintenance has included repair of a crack in an oil cooler support and applying a doubler to a skin crack near Station 324, in the center cabin area near the transmission.

One characteristic of the engine has been a deposit of carbon products from combustion on the airframe near the exhaust, resembling an oil leak from a distance. Maintenance procedure has been to clean the ship regularly to prevent the area from gradually spreading over the aircraft's left side. In addition the exhaust area is painted black.

Passenger reaction has been generally favorable, on the order of passenger acceptance of fixed-wing jet-powered aircraft. Previous experience of the passenger is the main criterion. Those who step off a jet transport and into a helicopter for the first time are apt to be disappointed. But those who have ridden piston-powered helicopters before are strongly impressed in the other direction.



Dramatic proof of AeroShell Oil W stability. Rocker box section (left) ran for 250 hours using a good straight mineral oil. Rocker box (right) ran over twice as many hours on AeroShell Oil W. Note remarkable cleanliness.

BULLETIN:

Shell answers the ten questions you might ask about AeroShell Oil W—world's first non-ash dispersant aircraft oil

Less oil consumption. Longer intervals between engine overhauls. Easier starting, faster warm-up, reduced wear on piston rings, cylinder bores, cam lobes, lifter faces, gears and bushings.

All these benefits have been obtained with new AeroShell® Oil W. Here, in handy question-answer form, are the facts.

1. What types of aircraft can use AeroShell Oil W? Piston engine planes of any size. Helicopters, too.

2. Why is it called a non-ash dispersant oil? Because it contains special additives that help keep tiny, ingested particles in the oil from clumping together and forming deposits. These particles remain suspended and dispersed until they burn.

3. How does this effect engine performance? It means that engine parts stay cleaner. That lubrication points get all the oil they need. *Your engine runs more efficiently, parts last longer.*

4. What about oil consumption? Because AeroShell Oil W means decreased wear and a cleaner engine, you can expect less oil consumption.

5. Can AeroShell Oil W reduce my maintenance costs? If you have been using a straight mineral oil, AeroShell Oil W can reduce your maintenance costs substantially. Reason: your engine runs cleaner and cooler. Oil consumption is less. Thus, you can extend intervals between engine overhauls.

6. How does this new oil respond from a cold start? AeroShell Oil W has an unusually high viscosity index. This guards against excessive thickening of the oil when cold, yet provides outstanding lubrication when hot. Result: *easier starting, faster warm-up.*

7. Is AeroShell Oil W thoroughly proved? Thoroughly. It's had millions of engine hours of flight time.

8. Where is it available? At Shell Aviation Dealers everywhere. *Any* dealer will stock AeroShell Oil W if you ask for it.

9. Can I add AeroShell Oil W as a make-up oil? Yes. It is compatible with all piston engine oils now being used.

10. Is there more than one viscosity grade? What do I ask for? AeroShell Oil W is available in *three* viscosity grades: 80 grade for small engines where straight mineral oil grade 55, 65, or 80 is normally recommended. Also in 100 and 120 grades for large engines where straight mineral oil grade 100 or 120 is normally recommended.

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Dissident Engineers Urge Rehiring Of Western Group to Avoid Strike

Washington—Dissident members of the Flight Engineers International Assn. last week urged a special three-man presidential panel to ward off possible renewal of the February wildcat strike against six airlines by persuading Western Air Lines to rehire 124 engineers fired after the five-day walkout began.

Representing groups from American, Pan American, Trans World, Eastern and Western Air Lines, a delegation of the engineers met with Nathan Feinsinger, chairman of the special panel. They said the strike nearly erupted again Mar. 25 because of the Western situation, but was shelved by complaining engineers to permit the delegation, known as the Flight Engineer Coordinating Assembly, to lay its problems before the Labor Department and the AFL-CIO in Washington. The group indicated it expected the three-man panel to assure them of some results "within a week or 10 days" or more than 2,500 flight engineers could be expected to resume the walkout.

Feinsinger's office later announced that the rebel engineers, who do not have the sanction of FEIA executive approval, pledged their "full cooperation" to help the panel settle the dispute.

Western Air Lines said that it resumed negotiations with FEIA over wages and working conditions the day after the dissident group's visit to Washington. Airline spokesmen said the talks did not include the issue of rehiring the 124 engineers.

Al Kiburis, a TWA flight engineer and spokesman for the assembly group, said the over-all dissatisfaction of FEIA members with the lack of support given the union by the AFL-CIO, and a sharp rebuff by top officials of the union who refused to listen to their complaints, may start an immediate move for affiliation with the International Brotherhood of Teamsters.

Immediately after their AFL-CIO visit, the delegation went to Teamster headquarters where they say a union official was "very receptive" to the idea of an affiliation, since the larger union is creating an air transport division and expects to make it formal at its July convention in Miami.

Supersonic Transport Budget Requested

Washington—President Kennedy asked Congress last week to authorize the Federal Aviation Agency to spend $12 million on the initial phases of joint government-industry development of a supersonic transport.

Although the President asked $12 million in new Fiscal 1962 obligational authority, FAA expects to spend only $10 million on the supersonic transport program during the next fiscal year. President Eisenhower omitted any request for funds to support the supersonic transport when he submitted his Fiscal 1962 budget before leaving office.

Funds will be used to cover costs of technical studies and analyses by airframe and engine manufacturers leading to preliminary concept and design proposals which would define scope, cost and time phasing of the project, as well as market potentials for such an aircraft. Contracts will be let on a competitive bid basis.

President Kennedy also asked for an additional $35 million over the $40 million already requested for federal aid to airports during Fiscal 1962.

An increase of $100,000 in the budget for the Civil Aeronautics Board was requested for a special policy study by private consulting firms to determine most urgent needs for the Board. Studies will include surveys on the role of supplemental air carriers and the development of adequacy of service standards.

CAB Action Paves Way For Cargo Rate Talks

Washington—Civil Aeronautics Board paved the way last week for reopening of the International Air Transport Assn. traffic conference on North Atlantic cargo rates by temporarily lifting its requirement that charter of aircraft to U. S. freight forwarders should not be prohibited.

As a result of the Board action, IATA traffic conference members have agreed to reconvene in a last-ditch effort to reach an agreement that will prevent a rate war on the North Atlantic. Current rates, which were to expire Apr. 10, have been extended to June 30.

In a mail vote, carrier members agreed to make a final attempt to settle the rate issue, but several carriers stated they would join in the special meeting only if the Board removed its condition on charter flights.

On Jan. 23, the CAB approved an IATA charter resolution on condition that the resolution "shall not prohibit the charter of aircraft to U. S. international freight forwarders." By chartering whole flights, freight forwarders have been able to sell space to shippers at a lower rate per ton mile than is charged by the common carriers, thus draining off substantial volumes of cargo from the airline market potential.

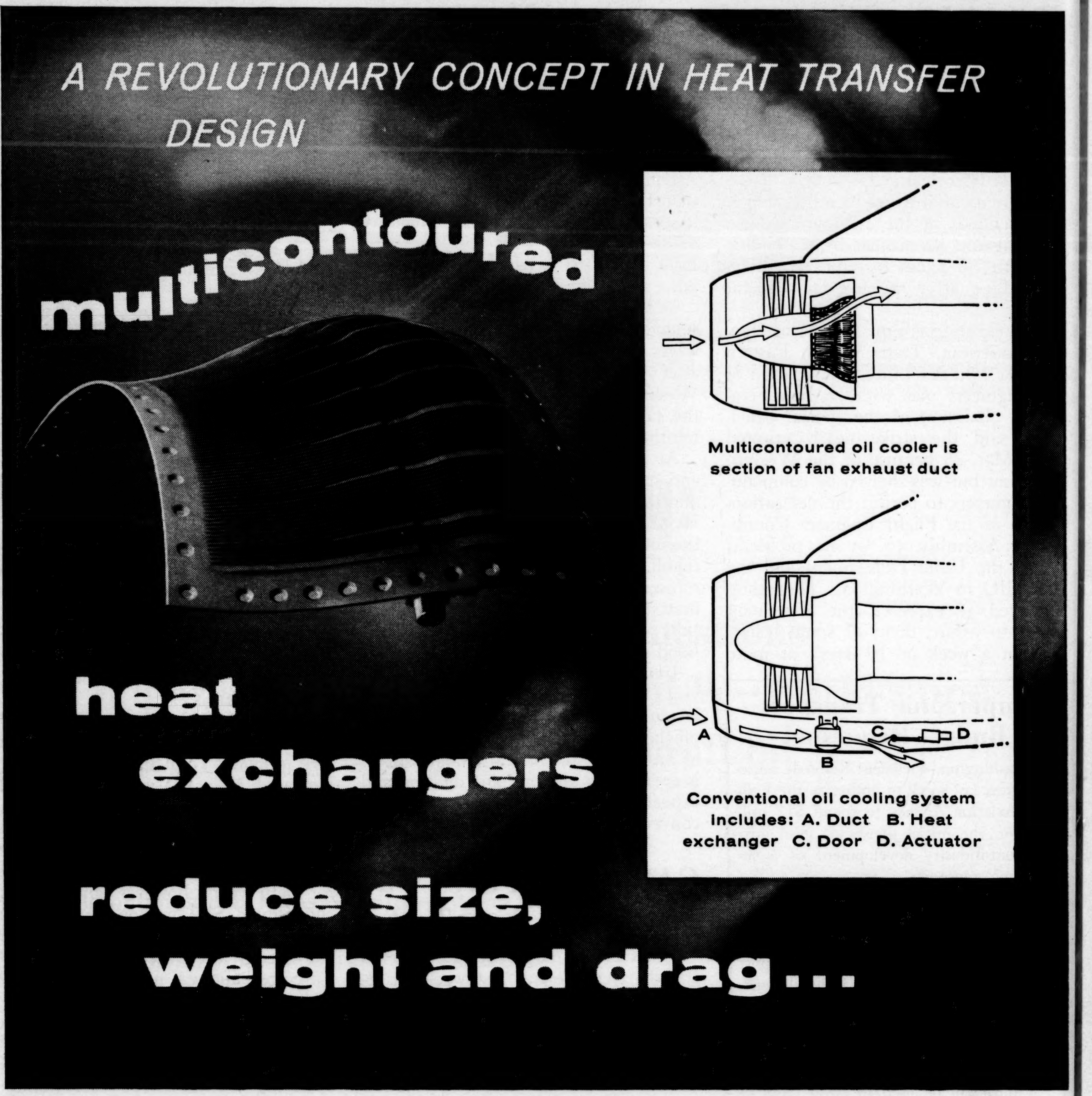
The Board agreed to remove the charter condition with respect to transatlantic cargo traffic moving westbound if the conference agreed to maintain present cargo rates until July 1, meet in conference as soon as possible and agree on a satisfactory structure for a reasonable period of time after July 1.

Airline Profits Fall Behind Revenue Pace

Washington—Four major airlines report their profits failed to follow a rising trend in revenues last year.

Continental Airlines' profit held about even in 1960, while Braniff, Western and United profits declined. Their reports:

- **Braniff Airways** reports operating revenues increased 16% to $86.5 million in 1960, while operating expenses increased 20% to $83.9 million. Operating profit dropped from $5.2 million in 1959 to $2.6 million in 1960, and net earnings fell from $2.5 million to $720,000 last year.
- **Continental Air Lines** reports 1960 operating revenues increased 33% to $61 million. Total operating expenses increased 30% last year to $54.6 million. Operating profit for 1960 was $6.4 million—a 66% increase over 1959's $3.8 million. Net profit remained about the same at $1.7 million for both years, however, aircraft sales contributed $1.2 million of Continental's 1959 earnings, while in 1960, aircraft sales accounted for $200,000. Cargo revenue was up 54% over 1959, and passenger revenue increased 32%. Continental's five Boeing 707s earned 53% of 1960 passenger revenues.
- **United Air Lines** reported 1960 total operating revenues of $379.1 million, compared with $329.2 million for 1959. Operating expenses totaled $363.7 million for 1960, compared with $308.3 million for 1959. Operating income was $15.5 million—down from $20.9 million in 1959. United's net income for 1960 was $11.1 million, including $4.52 million from aircraft disposal. Net income including $3.6 million from sale of aircraft for 1959 was $13.8 million. Operating expenses climbed 18% during 1960.
- **Western Air Lines**' total operating revenues for 1960 were $69 million, compared with $63.2 million for 1959. Total operating expenses were $63 million, compared with $52.1 million in 1959, and operating profits were $6.1 million last year and $11.1 million in 1959. Net income was $2.3 million for 1960 and $4.8 million for 1959.



Multicontoured oil cooler is section of fan exhaust duct

Conventional oil cooling system includes: A. Duct B. Heat exchanger C. Door D. Actuator

This finned surface oil cooler, used for cooling constant speed drive or turbocompressor lubrication oil circuits, is a structural member of the fan exhaust duct. This eliminates the need for air scoops and special ducting.

These installations are already in use on Boeing 707-720B turbofan aircraft and may be shaped to any configuration at extremely close tolerances. Comparable in price to conventional heat exchangers, they are even more reliable and have a longer service life because of their basic simplicity.

Unique manufacturing techniques developed at AiResearch enable this aluminum unit of welded and all-brazed construction to withstand severe structural and pressure loads. Similar units have been developed for non-by-pass gas turbines and ram air ducts. This major breakthrough in heat exchanger design and fabrication is the result of more than 20 years of experience by the company in the design, development and production of heat transfer equipment.

• Please direct inquiries to the Los Angeles Division

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Delta Studies New Jet Equipment; Prepares for West Coast Service

New York—Delta Air Lines considers its present jet fleet of six Douglas DC-8s and 12 Convair 880s delivered or on order as adequate to begin West Coast service, but is considering buying additional equipment.

Certification for Delta's newly awarded routes in the Southern Transcontinental Case (AW Mar. 20, p. 36) is expected June 11, and Delta will be ready to begin service then with DC-8 aircraft and piston-powered DC-7s as well, Todd Cole, vice president-finance, told the New York Society of Security Analysts.

Though Delta was granted considerable new mileage, Cole said this entailed only four new cities for Delta, which has operated a Los Angeles interchange service with American Airlines. Previous identification with the market, including existing offices on the West Coast, should prevent an extended period of initial unprofitable operation, Cole said.

One projection of possible operation of a nonstop Atlanta-Los Angeles and Dallas-Los Angeles service as a conversion of the existing DC-8 interchange would generate $11 million annually in revenues. Delta's new route is a relatively thin one, however, Cole said, and will need intensive cultivation.

DC-8s can be drawn from the slack summer Florida routes for initial service, Cole said, and Delta's last three 880s, due for delivery in August and September, will permit augmentation of West Coast frequencies.

As to new equipment, Cole said that Delta could get delivery of DC-8s, 880s or Sud Caravelles in 1962 or the Boeing 727 in 1963 or later. Since any new airplanes would be bought as much to meet additional traffic growth as well as the West Coast market, Delta is debating the advantages and disadvantages of short-medium-range aircraft like the 727 or Caravelle:

- **Short-medium-range** jet planes, especially with turbofan engines, would be more efficient on many of Delta's routes.
- **Offsetting such savings** would be the added cost of placing an entirely new type of airplane in service, training costs in particular.

Cole said Delta had not reached any decision, but felt that these latter expenses could well exceed the costs of operating larger aircraft on routes to which they were not best suited.

Retrofitting its DC-8s with turbofan engines is a possibility, Cole said, though he commented wryly:

"I'm a little aghast at the number of dollars the manufacturer is talking. When we were talking to the manufacturer about orders, engine change was described to us as just a case of zip in and zip out."

Still, Delta follows the DC-8 fan certification program with great interest.

Financing of new jet orders would depend on timing. Delta is generating substantial amounts of cash through amortization and net depreciation and deferred taxes—$47 million projected for the three years 1961-63, which is comfortably more than required for payments due for the remaining 880s and for loan repayment.

Cole termed the Civil Aeronautics Board decision in the Southern Transcontinental Case a good omen for the industry in general, heralding a new stability in route systems.

The Board realistically refused to provide competing service between Miami and the West Coast and followed the same approach in Atlanta and West Coast service, Cole said. This approach recognizes that the amount of traffic that would support competing traffic in piston equipment will not do so in jet equipment.

Cole also considered the Board's decision in the General Passenger Fare Investigation as the basis for a new era of financial stability for the industry as a whole. Implicit in the decision, Cole feels, is that as long as the airlines are not reaching the reasonable rates of return specified in the decision, the regulatory climate will be favorable toward helping the airlines reach them. Also, Cole feels that there will not be immediate imposition of ceilings if earnings do reach or temporarily exceed these levels.

Whether Delta will actually seek a fare increase on the basis of the decision is another matter.

"Any increase in fare level will have a depressing effect on rate of growth," Cole said. "Revenue developed from higher load factors is much healthier than from increased fares. A 3% increase in load factor will accomplish the same thing as a 5% increase in fares for Delta.

"The encouraging thing for me about CAB is its intent to coordinate its route philosophy with its rate regulation. Competitive route awards, which in some instances only gave the passenger the right to choose between four or five different paint schemes, brought about the need for higher fares. Such coordination will help airlines to protect their franchises by offering adequate service, both frequencies and equipment."

On the basis of Delta's earnings of $2½ million in its latest fiscal year, an 11% rate of return as permitted by the Board for the intermediate-size carriers would have produced earnings of $5½ million in the same period.

In the first eight months of its current fiscal year, which ends June 30, Delta net earnings on operations totaled $1,664,000, or, adding proceeds from equipment sales, $2,190,000. This represents a 6% return on investment, or 2% on sales. Cole did not project earnings for the year, but estimated revenues would total $140 million.

Sabena Acquires Interest in TSA

New York—Sabena Belgian World Airlines has acquired 30% of the stock in TSA Transcontinental, the Argentine airline, and has taken over TSA's sales and service functions here.

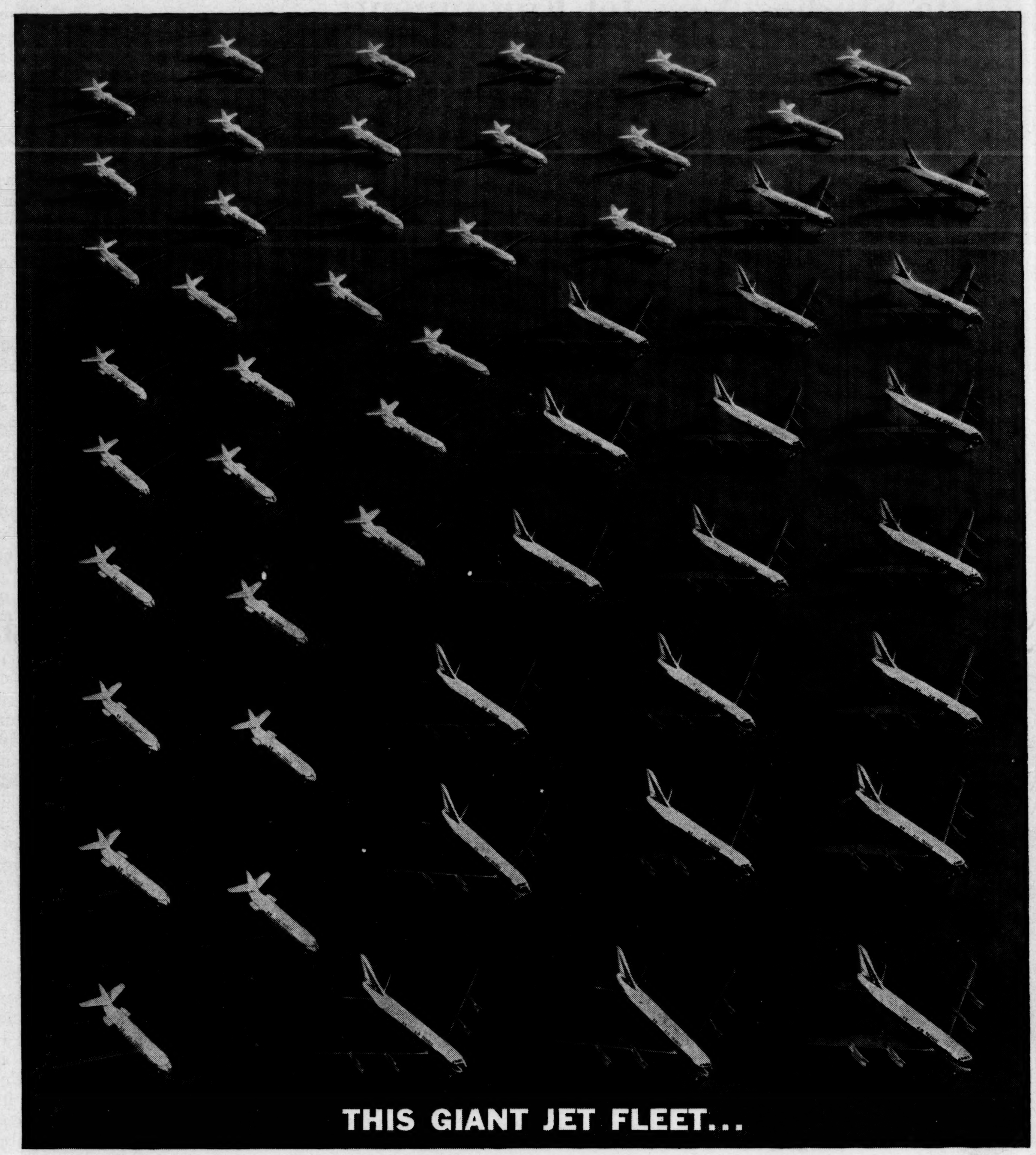
Under a general sales agreement signed recently between the carriers, Sabena will handle TSA's sales, reservations and similar services on a worldwide basis except in South America. TSA will perform the same services for Sabena in South America.

TSA, Argentina's largest private-enterprise airline, inaugurated Buenos Aires-New York service in September, 1958 with Lockheed Super H Constellations (AW Oct. 6, 1958, p. 38). It now operates Bristol Britannia turboprops on the route. TSA is not a member of International Air Transport Assn.

Apparently TSA failed to crack the U.S. market in the highly competitive South American traffic. Most of the airline's business was of South American origin and southbound trips carried few American tourists. On Mar. 1, TSA began sharing Sabena facilities at New York International Airport. Under the new agreement, TSA closes its sales offices in the U. S. and Sabena takes over these functions. Sabena also will continue to handle servicing at Idlewild of TSA aircraft.

The agreement allows Sabena a link to rich South American routes operated by TSA, including extensive domestic services in Argentina and a route to Mexico City, which Sabena also serves. TSA also has been hoping eventually to fly on from Mexico City to San Francisco and Tokyo.

According to Sabena, TSA expects to be operating jets on the New York route "within a few months." Initially these may be Sabena Boeing 707-320s on an interchange basis, providing the Belgian carrier can spare the planes.



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Already well over one million people have flown Air France Jets. For Air France Jets fly around the world. Air France Boeing 707 Jets fly direct to Europe from New York, Los Angeles, Chicago, Montreal, Anchorage and Mexico City. Air France Boeing 707 Jets also provide swift giant steps from Europe to South America, Africa and the Far East. And the outstanding Air France Caravelle Jets serve 42 cities in Europe, North Africa and the Middle East.

The pilots who fly Boeing 707 Jets are as remarkable as the jets they fly—6,000,000-mile-experienced veterans. No other airline in the world has higher standards for flight personnel. Small wonder that Air France, with a 42-year record of flying experience and service, is the world's largest airline.

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Airline Income & Expenses—January 1961

(IN DOLLARS)

	Passenger Revenue	U. S. Mail	Express	Freight	Charter	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
DOMESTIC TRUNK								
American	30,574,502	677,197	284,023	1,805,672	....	33,656,155	12,106,460	673,113
Braniff	5,717,757	142,062	69,856	184,768	39,406	6,200,192	6,083,779	18,909
Capital	7,827,002	192,812	120,210	150,724	14,750	8,050,031	5,212,892	−1,604,642[3]
Continental	4,694,000	78,000	41,000	106,000	30,000	5,074,000	4,686,000	115,000
Delta	11,874,000	206,000	82,000	280,000	15,000[2]	12,649,000	11,534,000	882,000
Eastern	21,494,012	472,742	....	1,033,998[4]	397	23,043,907	24,117,874	−1,073,967
National	5,785,052	102,058	23,462	200,558	101,468	6,478,022	6,550,912	−247,582
Northeast	3,272,118	57,282	26,546	85,417	....	3,523,363	4,325,114	−911,253[3]
Northwest[1]	....	....	....	....	....	....	....	....
Trans World	19,716,069	465,386	....	....	140,533	21,693,472	22,787,267	−2,201,969
United	27,825,182	1,155,018	2,291,134[4]	....	56,509	31,443,705	32,218,687	−1,426,069
Western	4,916,982	101,814	191,215[8]	....	95,661	5,324,598	4,843,911	416,553
INTERNATIONAL								
American	399,953	6,733	303	64,901	....	496,867	243,973	197,958
Braniff	821,716	21,419	....	42,000	....	952,711	993,589	−59,877
Caribbean Atlantic	287,245	2,960	14,576[4]	....	2,226	311,543	287,536	24,103
Delta	153,000	1,000	....	3,000	....	170,000	281,000	−118,000
Eastern	2,805,947	55,384	....	127,537	....	2,907,987	2,775,052	159,809[3]
Mackey	115,922	....	658	3,797	....	136,261	163,708	22,153[3]
National	56,001	115	....	140	....	59,863	110,512	−50,649
Northwest[1]	....	....	....	....	....	....	....	....
Pan American Combined	21,821,000	2,473,000	....	3,409,000	897,000	29,630,000	34,059,000	−5,194,000
Alaska	306,000	16,000	....	29,000	....	354,000	511,000	−164,000
Atlantic	8,517,000	1,060,000	....	1,214,000	203,000	11,419,000	14,756,000	−2,935,000
Latin American	6,564,000	185,000	....	960,000	43,000	8,143,000	9,550,000	−1,410,000
Pacific	6,434,000	1,212,000	....	1,206,000	651,000	9,714,000	9,241,000	344,000
Panagra	1,230,000	55,000	....	204,000	....	1,673,000	1,873,000	−243,000
Resort[9]	....	....	....	....	....	....	....	....
Trans Caribbean	....	....	....	....	....	....	....	....
Trans World	2,768,082	599,673	....	....	500,095	4,645,109	6,404,281	−1,817,101
United	1,482,754	83,873	42,478[4]	....	....	1,663,046	1,262,413	367,761
Western	308,091	4,044	12,689[8]	....	....	326,849	428,190	−108,318
LOCAL SERVICE								
Allegheny[1]	....	....	....	....	....		....	....
Bonanza	394,830	4,604	2,216	6,078	....	681,381	643,392	23,417
Central	201,831	6,100	1,830	7,546	8,078	227,914	462,795	28,877
Frontier	540,691	16,826	4,168	24,025	4,008	1,131,511	1,137,326	−16,951
Lake Central	261,774	6,558	9,065	....	....	538,998	514,667	24,330[3]
Mohawk	838,702	18,328	11,781	17,305	15,708	1,168,761	1,263,630	−140,430[3]
North Central	1,194,650	36,291	24,000	30,589	....	1,981,085	1,973,586	−12,807
Ozark	634,803	22,081	12,056	21,879	1,433	995,560	998,112	−15,256[3]
Pacific[1]	....	....	....	....	....	....	....	....
Piedmont[1]	....	....	....	....	....	....	....	....
Southern	401,900	15,515	5,526	10,611	296	788,011	821,107	−10,069[3]
Trans-Texas	401,061	15,434	5,400	14,406	6,623	695,946	726,293	−38,235
West Coast	528,136	11,196	3,491	8,361	1,716	1,021,735	938,005	64,138
HAWAIIAN								
Aloha	315,174	1,914	....	4,610	....	330,165	420,981	−113,323[3]
Hawaiian	423,464	3,279	....	67,696	112,159[2]	616,489	726,254	−130,146[3]
CARGO LINES								
AAXICO[9]	....	....	....	....	....	....	....	....
Aerovias Sud Americana	....	....	....	47,165	....	195,585	238,970	−33,661[3]
Flying Tiger	....	15,089	922,552[4]	....	1,580,126	2,533,227	2,472,944	9,917
Riddle	....	....	....	671,576	....	687,404	832,700	−105,850[3]
Seaboard & Western	....	....	....	....	....	....	....	....
Slick	....	....	....	....	....	1,293,576	1,167,405	78,767[3]
HELICOPTER LINES								
Chicago Helicopter	127,997	135,898	....	....	....	263,903	296,806	−33,525
Los Angeles Airways	19,553	13,815	12,312[5]	....	....	137,027	130,026	8,080
New York Airways	77,429	4,924	3,152	3,006	....	286,785	310,509	−25,461
ALASKA LINES								
Alaska Airlines	205,296	71,873	377	35,136	271,856	762,747	718,593	31,328
Alaska Coastal	54,745	8,297	....	6,378	1,399	155,766	165,093	−11,913[3]
Cordova	10,673	12,457	....	9,626	18,153	96,578	84,794	10,382
Ellis	32,664	3,658	....	3,410[4]	591	87,971	107,795	−19,947[3]
Kodiak	13,073	796	....	1,812	943	20,087	23,210	−1,904[3]
Northern Consolidated	49,569	60,727	....	21,864	2,671[2]	230,076	244,450	−9,586[3]
Pacific Northern	584,728	86,623	2,957	95,832	9,560	1,000,042	965,678	29,378
Reeve Aleutian	121,665	33,445	....	34,953[8]	9,652	202,058	178,530	23,067
Western Alaska	6,346	9,547	....	658[8]	2,515	19,119	9,072	−2,070[3]
Wein Alaska	38,716	41,487	....	20,025	6,827	299,222	348,615	−58,563[3]
Avalon Air Transport[1]	....	....	....	....	....	....	....	....
Samoan[1]	....	....	....	....	....	....	....	....

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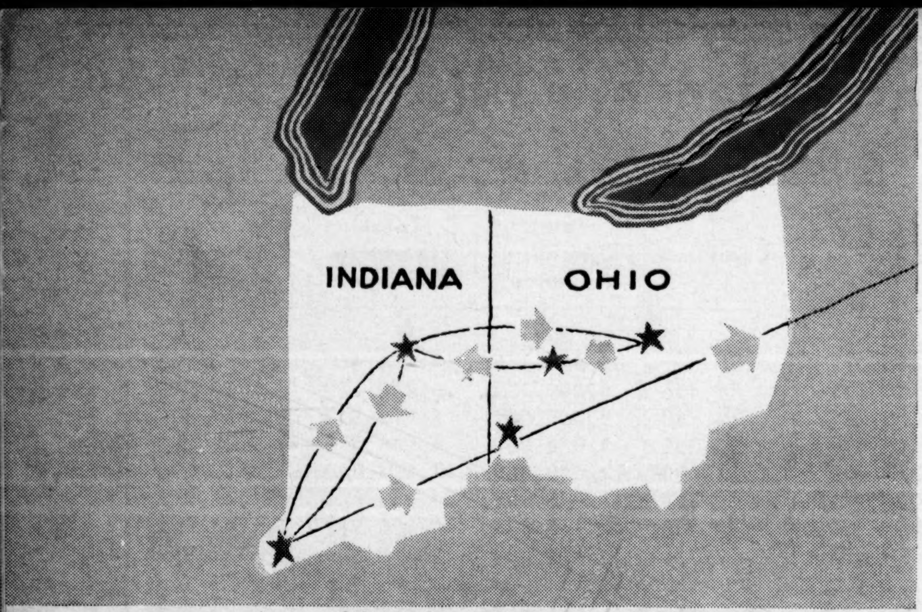
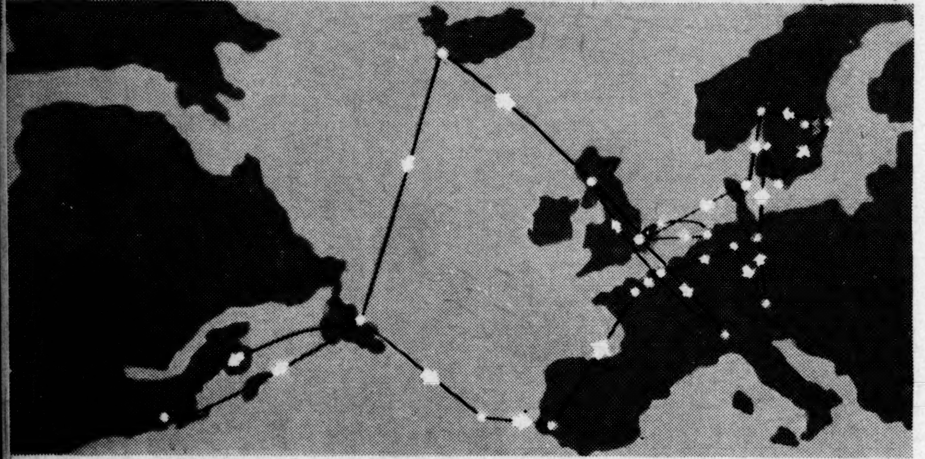
[1] Not available. [2] Non-scheduled transportation or other transportation. [3] Operating profit or loss. [4] Property. [5] Express & excess baggage. [6] Airline division operations. [7] Incidental revenue. [8] Includes freight & excess baggage. [9] No operations this month.

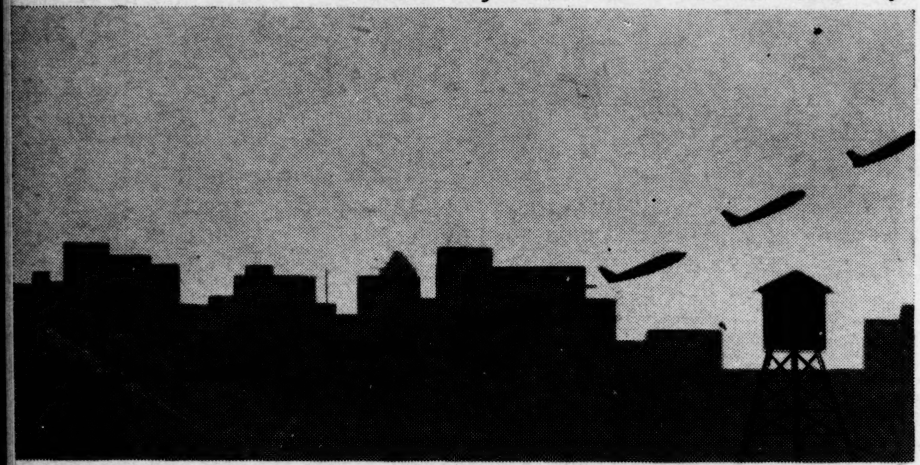
Compiled by Aviation Week from airline reports to the Civil Aeronautics Board.



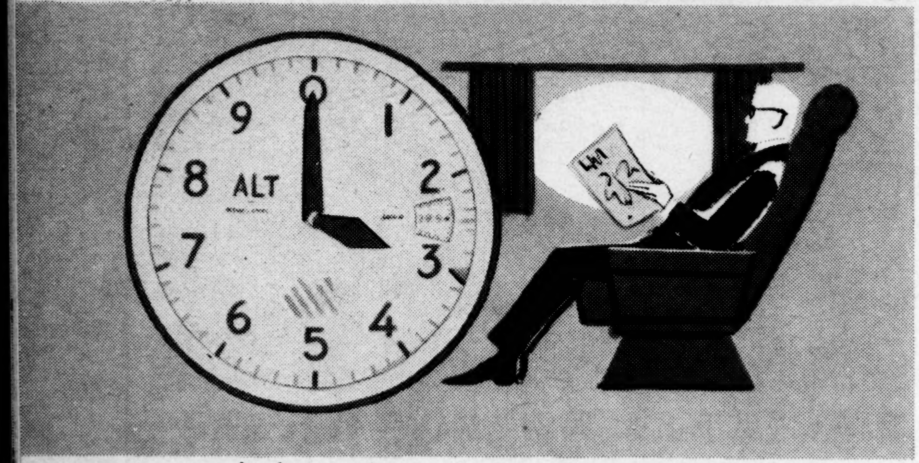
▲ Ideal for 71-mile or 7100-mile trips ▼



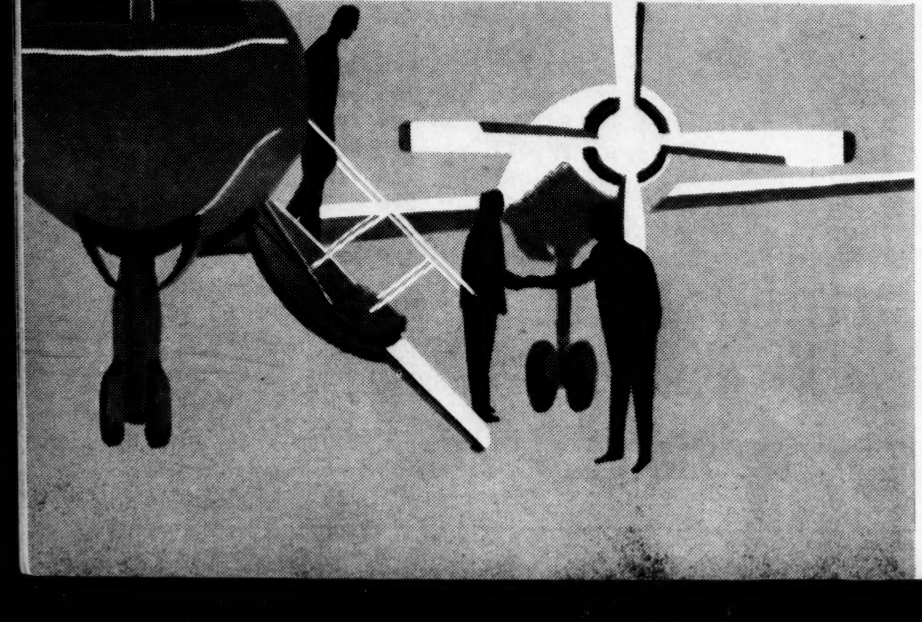
Needs only 3500-4000 feet of field ▼



Pressurization system to 30,000 feet ▼



Independent of ground handling facilities ▼



The Gulfstream: the most do-everything business airplane there is!

The only aircraft in its class designed exclusively as a business airplane, the Grumman Gulfstream offers unique flight-and-ground flexibility. The following case history proves it.

Here's a factual example of Gulfstream flexibility. It's a story of how one Grumman Gulfstream was utilized as a sales tool by a well known chemical manufacturer on two important field trips. On both these trips the passengers were able to fly above weather or traffic, in comfort, in Gulfstream's pressurized cabin. They were able to land and take off from short fields close to their destinations, completely independent of ground handling facilities. And they were able to get to their destination faster because of Gulfstream's high door-to-door time and 350mph cruise speed.

TRIP NO. 1, 17½ HOURS. This field trip was arranged through Ohio and Indiana to bring together a group of distributors, providing each with an opportunity to observe one another's operations, and also to help integrate local with national sales promotion. On this trip, *during*

GRUMMAN GULFSTREAM

a single day, the Gulfstream made 8 stops to visit 6 distributors, and covered 1,356 miles. Cities visited included Evansville, Indianapolis, Dayton and Columbus (only 71 air miles apart) and Cincinnati. That night the plane returned to New York. Minimum number of passengers was 5—maximum, 12.

TRIP NO. 2, 17 DAYS. This same company visited its European distributors to set up new outlets for its products and to outline plans and programs for the coming year. Fourteen countries were visited. Meetings were held and plant tours were conducted in Paris, London, Zurich, Lisbon, Brussels, Cologne, Stockholm, Oslo, Copenhagen and many other cities. The manufacturer's comment on this trip—his second overseas in six months—was "on schedule—maintenance zero."

Flexibility like this—flexibility that makes the Gulfstream ideal for 71-mile or 7100-mile trips—is one reason why over 60 Gulfstreams are now in operation. Other reasons are Gulfstream's proven safety, reliability, comfort and beauty. In short, it's a sound business investment.

Corporate executives and pilots may arrange for demonstration flights through the following distributors: *In the United States:* Atlantic Aviation, Wilmington, Del. Pacific Airmotive, Burbank, Cal. Southwest Airmotive, Dallas, Tex. *In Canada:* Timmins Aviation, Montreal. *In Europe:* Atlantic Aviation Export Corporation, London, England.

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AIRLINE OBSERVER

▶ Civil Aeronautics Board delay in issuing a formal decision in the United-Capital merger case is due to the Board's desire to incorporate its merger policy. CAB wants this decision to serve as a precedent for future merger cases.

▶ Domestic trunkline traffic suffered severely during February. Because of the flight engineers' walkout during the month (AW Feb. 27, p. 36), traffic figures are not representative, but indications are that the industry will show approximately a 10% traffic decrease from the previous February.

▶ Watch for Douglas Aircraft Co. to win new orders for DC-8s as a result of the Southern Transcontinental Route Case decision and because of creation of an equipment pool in Mexico. National Airlines will need additional jet equipment urgently for its new Florida-West Coast routes, and quick delivery will make the DC-8 a strong contender. Delta Air Lines may be a longer term sales prospect (see p. 45). Delivery will be a factor in the Mexican situation, but the influence of SAS, a DC-8 operator, through its investment in Guest Aerovias will also be important. Aeronaves de Mexico, which had rejected the equipment pool idea when it received its own DC-8 by virtue of Eastern Air Lines surrendering a delivery position, now must face acceptance of the plan after losing its DC-8 in a crash at New York International Airport. Improved performance of the DC-8 with turbofan engines may be still another factor in the competitive scale.

▶ United Air Lines Executive Vice President A. M. deVoursney has been unofficially labeled the successor to President W. A. Patterson when he retires from active duty, probably in 1964.

▶ Russian domestic air fares, adjusted in terms of the new "hard" Soviet ruble (officially worth $1.11), are still higher than rail rates despite the series of tariff reductions announced by Aeroflot. On the short-haul, showcase Moscow-Leningrad route, the jet air fare is lower than the train fare—14 rubles, against 14 rubles and 20 kopeks. More representative tariffs are: Moscow-Kiev, 15 rubles by air, 12 rubles and 80 kopeks by rail; and Moscow-Omsk, 40 rubles by air, 35 rubles and 10 kopeks by rail. On the long-distance (5,000 mi.) Moscow-Vladivostok route, air fares are more than a third higher than rail rates.

▶ Group of 12 African states will organize and operate a joint domestic and international airline under a pact which links these nations' political and economic programs. Countries are Mauritania, Senegal, Ivory Coast, Voltaic Republic, Dahomey, Cameroon, Chad, Central Africa Republic, Gabon, Madagascar and the former French Congo.

▶ Prospects now appear slim for full agreement between the U. S. and India on amendments to the bilateral air transport agreement between the two countries when negotiations are resumed this month in Washington. Talks broke up in deadlock last year in New Delhi over India's insistence that capacity and schedule restrictions be imposed upon U. S. flag carriers serving India. U. S. opposition to restrictions is not expected to slacken during renewed talks.

▶ Commerce Department has formed a transportation policy group to develop a national transportation program. The eight-man group includes Robert Lester, former secretary of the Civil Aeronautics Board, to represent aviation interests.

▶ Nigerian government will begin complete nationalization of Nigeria Airways Corp. this month. The government is buying the 49% of outstanding stock now held by British Overseas Airways Corp. and Dempster Shipping Lines.

▶ Civil Aeronautics Board plans to hold the second stage of its public hearing on the cause of New York's Dec. 16 DC-8-Super Constellation midair collision during the last week in April. After 77 witnesses testified in a 10-day session last January, interested parties agreed that the accident's probable cause was not apparent from the record.

SHORTLINES

▶ **American Airlines** has grouped its passenger services into one department headed by Vice President W. G. Whitney. The new passenger services department will be responsible for technical reservations systems, reservations, ticket and terminal service, stewardess college and service, food service, cabin service and field performance appraisal.

▶ **Boeing 707 and 720 turbojets** in scheduled service have flown more than 20 billion passenger miles in over 550,000 flight hours since October, 1958.

▶ **British Overseas Airways Corp.** has asked Civil Aeronautics Board to extend its North Atlantic route beyond New York to Santiago, Chile, via Cuba, Panama, Ecuador and Peru. At the same time, the British airline announced it will self-insure its fleet of piston-engine aircraft. The carrier will make the move on the ground that premium costs on the fleet are too high.

▶ **Continental Air Lines** is installing a direct wire reservations system connecting major off-line cities with key Continental reservation offices. This system allows passengers, travel agents and connecting airlines to make reservations by calling local numbers.

▶ **International Air Transport Assn.** reports more than 1.9 million passengers and 46.8 thousand metric tons of cargo were carried over the North Atlantic during 1960, an increase of 24.7% for passengers and 28.7% for cargo over 1959.

▶ **Mexicana Airlines** reports a 41% gain in passengers for August, 1960, through January, 1961, over the same period the previous year. Mexicana attributes the rise to the introduction of Comet 4Cs.

▶ **Panair do Brasil** has received two Douglas DC-8 turbojet transports. The aircraft has a fifth pod between the left inboard engine and the fuselage for transporting spare engines.

▶ **Piedmont Airlines** was scheduled to begin service Mar. 30 on a new Norfolk, Va.-Knoxville, Tenn, route. Piedmont will fly three round trips a day using F-27 and DC-3 equipment.

▶ **Southern Airways** reports over 26,300 passenger boardings and 4.8 million passenger miles flown in February, a gain of 32% and 36% respectively over February, 1960.

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☆ Motorola's role as a major electronic system contractor for the B-70 Valkyrie's Mission and Traffic Control typifies its systems management capabilities. Detailed information is available on request.

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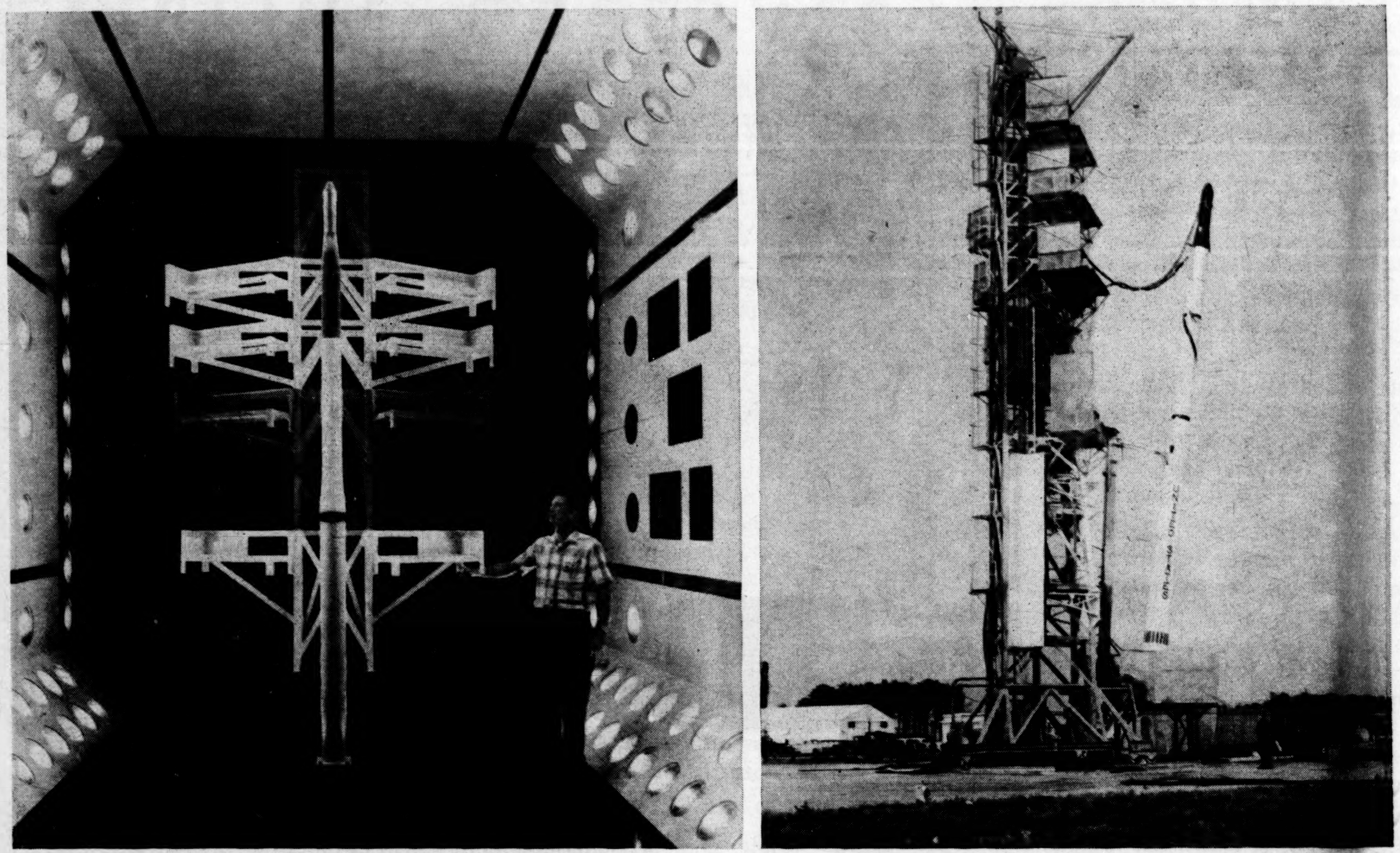


TESTS in transonic dynamics wind tunnel at Langley Research Center (left) proved spoilers were not necessary on Scout launcher to alleviate frequencies set up by high winds. The 71.4-ft. Scout is shown in launch position at Wallops Island, Va. (right). Despite cost increases, project officials feel a Scout mission can be completed for under $1 million.

Scout Shifting to Contractor Flight Phase

By Edward H. Kolcum

Langley Field, Va.—Scout solid-propellant launch vehicle is now shifting from National Aeronautics and Space Administration to prime contractor management for the second half of its flight test program and for operational launches.

Eight-launch development program to qualify the four-stage Scout for satellite, probe and re-entry missions is now at mid-point. Final four vehicle development shots will be made by Vought Astronautics Division of Chance Vought Corp., prime vehicle contractor to NASA.

Conceived originally as a vehicle to extend velocity capability for re-entry tests for advanced nose cones and boost-glide vehicles, Scout evolved as the single lightweight workhorse in the nation's long-term space plans. With the evolution came pressures of an unrealistic flight schedule to meet commitments for both U.S. and international payloads, and a series of difficult technical problems.

The fact that Scout has been largely successful in three of its first four shots and that the vehicle is essentially ready for operation three years after the program was authorized is attributed to a management philosophy unusual in an NASA research center. Research centers historically have dealt in advanced research rather than in flight hardware, and both industry and NASA space flight centers viewed the Langley experiment in operational hardware management with some skepticism.

William E. Stoney, Jr., Scout project chief, believes research needs a concrete goal and that the development of Scout actually was accelerated because specialists in such research areas as mechanics, guidance and aerodynamics were available immediately when problems appeared.

Management Alternative

The alternative would have been to place direction of the vehicle with Marshall Space Flight Center, the NASA propulsion facility, and put management and component development contracts out to industry. Because speed became the primary requirement and the program was already under way at Langley, development management was left there—at first reluctantly.

The Scout vehicle was conceived in July, 1957, by Stoney, Maxime A. Faget and Robert O. Piland when the National Advisory Committee for Aeronautic's Pilotless Aircraft Research Division saw a need to extend the performance capabilities of existing research rockets. Faget and Piland are now with NASA's Space Task Group. Hardware development was done more frequently by PARD than by other NACA divisions because research rockets, many of them for special purposes, have been used since 1945 to study transonic and supersonic characteristics of aerodynamic and nose cone configurations.

Largest of the family in the design phase in 1957 was the five-stage, solid-propellant Javelin using a Sergeant booster, which could take 40 lb. through a 16,000 fps. velocity profile. Flown for the first time in June, 1958, Javelin cannot duplicate the velocities involved in re-entering from earth orbits and interplanetary flights.

First Scout configuration envisioned by the PARD team was based on a booster cluster of three Sergeants, a single Sergeant second-stage, X-7 third stage, and X-248 fourth stage. By December, 1957, the team replaced the booster cluster with the improved Jupiter Senior, or Algol, which Aerojet-General Corp. had developed. Soon after Thiokol came up with an improved Sergeant, called Castor, which replaced the Sergeant second stage. By May, 1958, the design consisted of Algol and Castor, with Hercules-Allegany Ballistics Laboratory X-248s as both third and fourth stages. First two stages would be controlled, and last two were to be spin-stabilized. As a satellite launcher, this vehicle could put 50 lb. in a 300-mi. orbit.

First Money Committed

PARD received authority to continue design work in May, 1958, and it was then that that money was first committed to the project and contracts authorized. To increase the payload capability to the present 150 lb., it was decided to scale the third-stage ABL motor to a weight about five times the X-248. This third-stage Antares is the only new motor development in the vehicle, and it proved to be one of the principal problem areas not foreseen when an initial firing date of October, 1959, was scheduled.

All motor contracts were let by December, 1958, and $3 million was committed to contracts for Scout through that year. Vought Astronautics won a contract over 12 other bidders in April, 1959, to design, build, and make limited tests of four airframes, and to construct a launch tower. Minneapolis-Honeywell won the guidance contract from among eight bidders, and subcontracted the hydrogen-peroxide control jets to the Walter Kidde Co. The peroxide jets proved to be a second cause of delay in the launch schedule. Contracts awarded in 1959 totaled $6 million.

Earlier this year, Vought was named prime vehicle contractor, and was formally awarded a contract to launch the last four development shots.

The October first-flight date was recognized as unrealistic early in the program, but Stoney feels certain that without any engineering problems, first Scout launch could have been made in January or February, 1960, instead of July. Worst of these problems arose in thrust misalignment, which had to be well within the tolerances demanded for tactical missiles. Original goal was to settle for half the 0.5 deg. misalignment for which Sergeant is designed. Stoney said that his experience with earlier vehicles indicated the tolerances could be cut to 0.1 deg. in the upper stages, and 0.25 deg. in the first two motors.

Scout Flight Schedule

Eight-vehicle-Scout development schedule will conclude with four more flights, all scheduled this year. Vehicles will be launched at Wallops Island, Va., and will carry these payloads:

- **Scout 5—Micrometeoroid hazard satellite, weighing 115 lb. containing sensors to measure the effects of micrometeoroid impacts.**
- **Scout 6—Backup for micrometeoroid hazard. If initial launch is successful, payload probably will be a 17-in. spherical motor to be flown on a vertical trajectory in a high-velocity re-entry test.**
- **Scout 7 and 8—Two electron density probes, weighing 100 lb., to be flown to 6,000 mi. altitude.**

First four launches, also at Wallops, were two motor development shots, an unsuccessful satellite launch attempt, and successful orbit of Explorer IX.

Alignment Requirement

Alignment is essential so that control jets can be kept at a reasonable size to leave more total weight for payload. First problem was to measure thrust alignments, and then demand extreme care with geometry in motor production. Contractors have stayed within these tight limits on all shots—there was essentially a zero misalignment in the ABL third stage in launch of Explorer IX.

Development of a scaled-up X-248 brought headaches, however. Six early Antares static tests failed when the propellant burned through the plastic casings which used an advanced bonding material. ABL went back to the X-248 propellant-casing binder, and although the casings withstood the burning, the nozzle liners buckled inward from negative pressures of exhaust gas. ABL made an ingenious fix, Stoney said, by drilling a pattern of holes spaced an inch apart in nozzle shell to vent off gas.

Nozzle on the second-stage Castor burned off during the first static test, but this was quickly fixed by Vought by wrapping a heat-absorbing material around the nozzle.

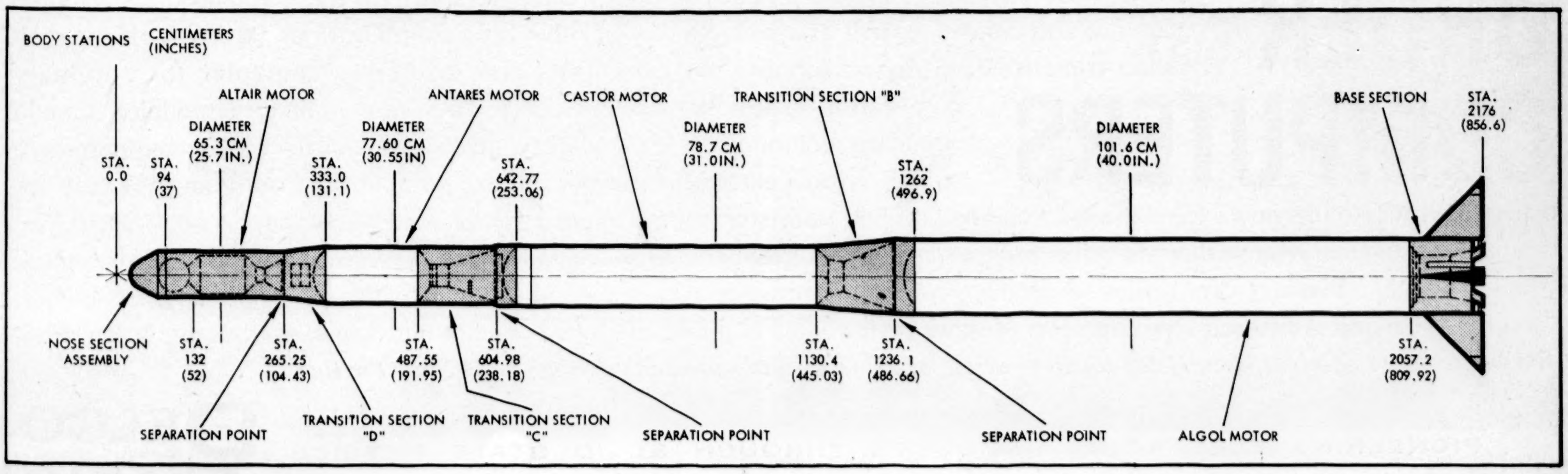
Hydrogen peroxide system for second and third-stage motor flight control was chosen over control of exhaust gas because NASA had considerable experience in use of peroxide controls for free-flight wind tunnel models. The problem with the Scout system is that peroxide is difficult to ignite immediately, and only a 90-millisecond delay can be tolerated from receipt of an error from the guidance package to correction responses by pitch, yaw and roll jets.

Control Jet System

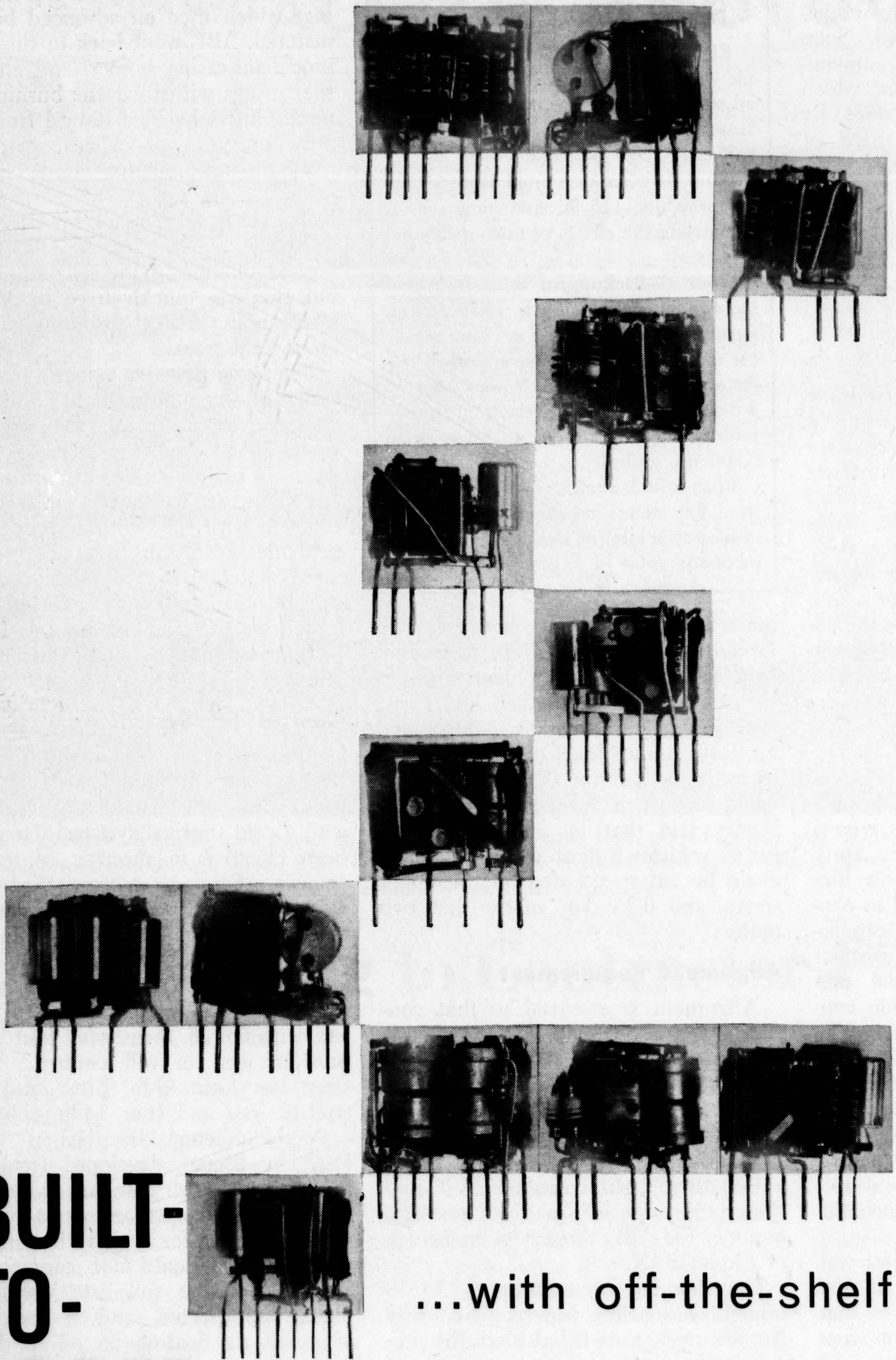
After rejecting such methods as preheating, and dribbling the fuel on a pre-catalyst, the Kidde Co. came up with a cold start catalyst bed which has been effective in meeting control responses. Peroxide motors themselves were redesigned after vacuum chamber tests showed the jet stream exhausted off-center.

Second-stage hydrogen peroxide system consists of two pitch and two yaw jets, with 600-lb. thrust, and four 20-lb. pressure jets for roll control. Third stage has four 40-lb. pitch and yaw control jets, and four 14-lb. roll jets.

A phenomenon described as "startling" by Stoney developed from the first Scout launch last July when the third stage developed an extremely high rolling torque, for which the original 4-lb. roll jets could not compensate. Stoney says the roll rate was completely unexpected, and it took use of a test rig floating on oil to deter-



GENERAL ARRANGEMENT of the Scout four-stage launch vehicle shows the way instrumentation is packaged in the motor transition sections. Sphere forward of the fourth stage represents a typical payload.



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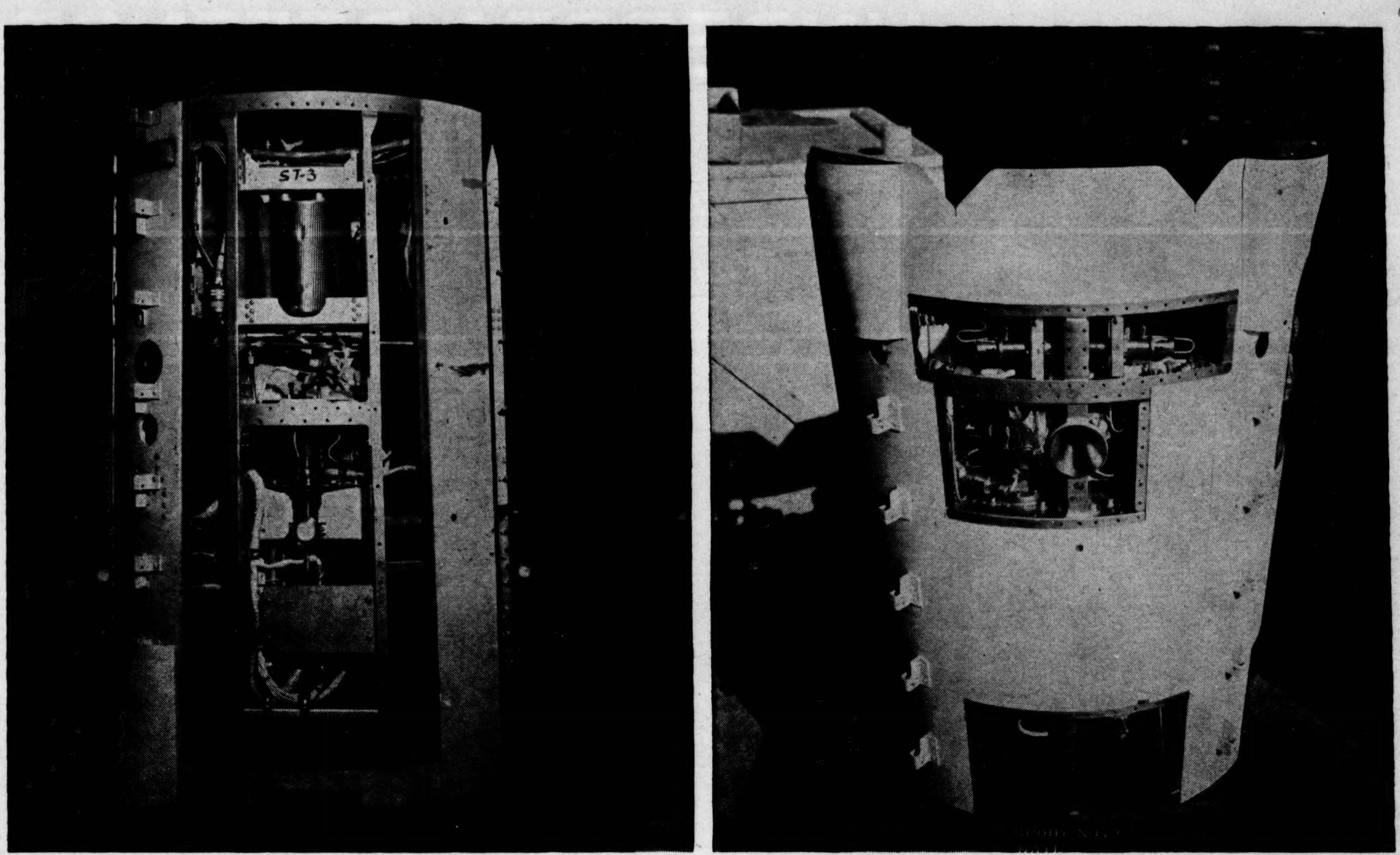


SCOUT transition section C, which is wrapped around the nozzle of the third-stage Antares motor (left). Components visible with service panel removed are the hydrogen peroxide storage tank at top, covered with insulation; rate gyro bracket and 44-lb.-thrust jet nozzle to control yaw. Nozzle for pitchup jet in transition section B (right), with insulated catalyst bed at left. The section surrounds the nozzle of the second-stage Castor motor. Nozzle on second-stage Castor burned off during first static test, so it is now insulated.

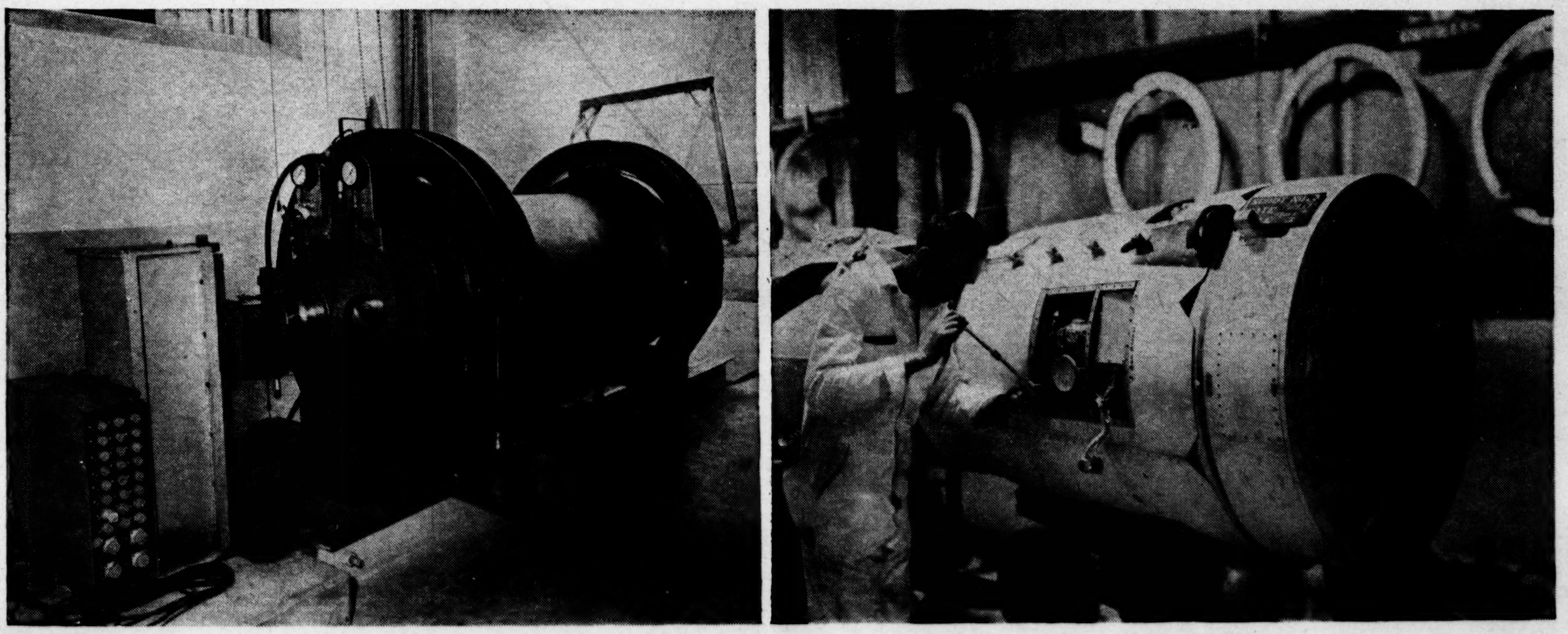
mine that high roll is an inherent characteristic of the X-254. Roll motor force was then raised to 14 lb.

Guidance package is a system of three single-axis reference gyros attached to the vehicle frame between the third and fourth stages. Azimuth and roll orientation are pre-set, and deviations are corrected by the gyros. Pitch programer works on a timer and feeds directions to the pitch-axis gyro.

First-stage control system required modification before the first flight because of a fear that the vehicle would flutter outside limits in the 3,000-4,000 psi. environment anticipated at maximum dynamic pressure and that the fins, which lose 10% of their surfaces through heating during flight, could not compensate for the flutter. Two fixes were made: a bearing was added to the aileron vane shaft, and the vane bearing box was redesigned.

Problem of exhaust gas building up in third and fourth stages and sealing the nozzles before separation was solved by venting the motor nozzles on both stages. Motors are separated by the firing blast of the succeeding upper stage.

Theory that spoilers would be needed on the launcher to baffle high winds was disproved in wind tunnel tests, but connections between third and fourth stages were stiffened when it was calculated that flexibility of the



HIGH ROLL TORQUE in the third-stage X-254 Scout motor, discovered in the first test launch, led to detailed study of the phenomenon with this oil-bearing test rig. Assembled transition section B, which bolts to the first-stage Algol motor, shows the blow-out separation diaphragm at right. Technician works on 600-lb.-thrust yaw control jet.

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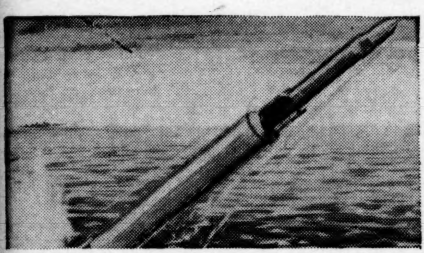

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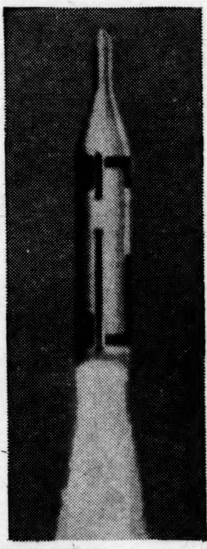

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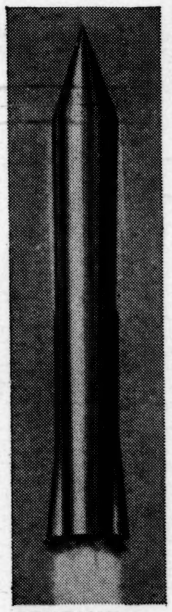

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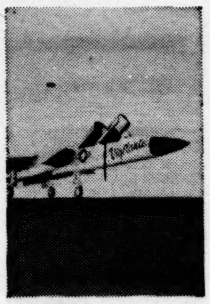

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Scout Motor Specifications

Motor Designation	Wt. (Lb.)	Propellant Wt. (Lb.)	Thrust (Lb.)	Burning Time (Sec.)	Specific Impulse (Sec.)	Dia. (In.)	Length (Ft.)
Aerojet-General Algol..... (Aerojet-Senior)	23,600	19,080	103,000	40	214	40	30.8
Thiokol Castor........... (XM-33-20-4)	9,600	7,300	62,000	27	224	31	20.7
Hercules-ABL Antares..... (X-254)	2,700	2,052	13,600	39	255*	30.55	11.1
Hercules-ABL Altair....... (X-248-A5)	525	455	2,800	38	255*	25.7	8.3

*—In vacuum

joining sections changes the effect of wind frequency. Scout is not launched in winds above 30 mph., but both launcher and vehicle withstood 100-mph. gusts during a hurricane last fall at Wallops Island, Va.

Stoney said that when development is complete, he believes all vehicle parts can be purchased for $500,000. Assembly, checkout, disassembly and delivery to Wallops will add $250,000. Launch costs—final assembly, checkout, erection on the launcher and firing—will total $80,000-100,000.

Air Force Blue Scout uses many of the same basic components as NASA's Scout, and both vehicles' systems are becoming more similar. Because Blue Scout is launched vertically, there are some differences in fittings, but essentially, the components are closely enough related that launches by either agency have reduced the development time of the other. NASA is integrating the USAF ignition system in its vehicle to further reduce the number of differences.

Blue Scout ignition is based on Atlantic Missile Range requirement for a faster checkout, while NASA's earlier versions did not have to meet this requirement.

Constant U.S.-Europe Satellite Link Studied

Washington—System of 18-28 inflatable 100-ft. passive satellites in 3,000-mi. circular orbits could provide virtually uninterrupted communications between North America and Europe, according to a National Aeronautics and Space Administration study.

The study assesses geometric and probability factors which control the lowest practical orbit and least number of satellites for an efficient transatlantic communications system. Authors are Floyd V. Bennett, Thomas L. Coleman and John C. Houbolt of the Langley Research Center, who reported their findings in NASA Technical Note D-619.

As many as six 500-lb. stiffened Echo spheres could be orbited by a single Atlas Agena B. NASA's Rebound program, scheduled for operations in mid-1963, calls for multiple satellite launches with one Atlas Agena. Programed orbital altitude for Rebound is 1,500 mi.

The Langley group studied orbital altitudes ranging from 1,000 to 5,000 mi.; minimum elevation angle of line of sight between satellite and ground station from zero to 10 deg., and usable communication time ranging from 90-99.9%. Among the conclusions:

- **Compromise must be reached** on orbital altitude, because the higher the orbit, the fewer satellites required, but electronics requirements and launch vehicle capacity increase with altitude.
- **Altitude increase** from 1,000 to the 2,500-3,000-mi. range reduces the number of satellites required considerably, but the reduction rate above 3,000 mi. is much less.
- **Some dead communications** time must be tolerated because double the number of satellites is required for 99.9% of service as is required for 90% uninterrupted service.

In order to communicate 90% of the time, according to the report, a minimum of 7-10 satellites would have to be placed in 5,000-mi. circular orbits.

At a 4,000-mi. circular orbit, required number of satellites would be 8-11; at 3,000 mi., the number would increase to 9-13. The number at 2,000 mi. would be 12-23, and at 1,000 mi., it would jump to 27-60.

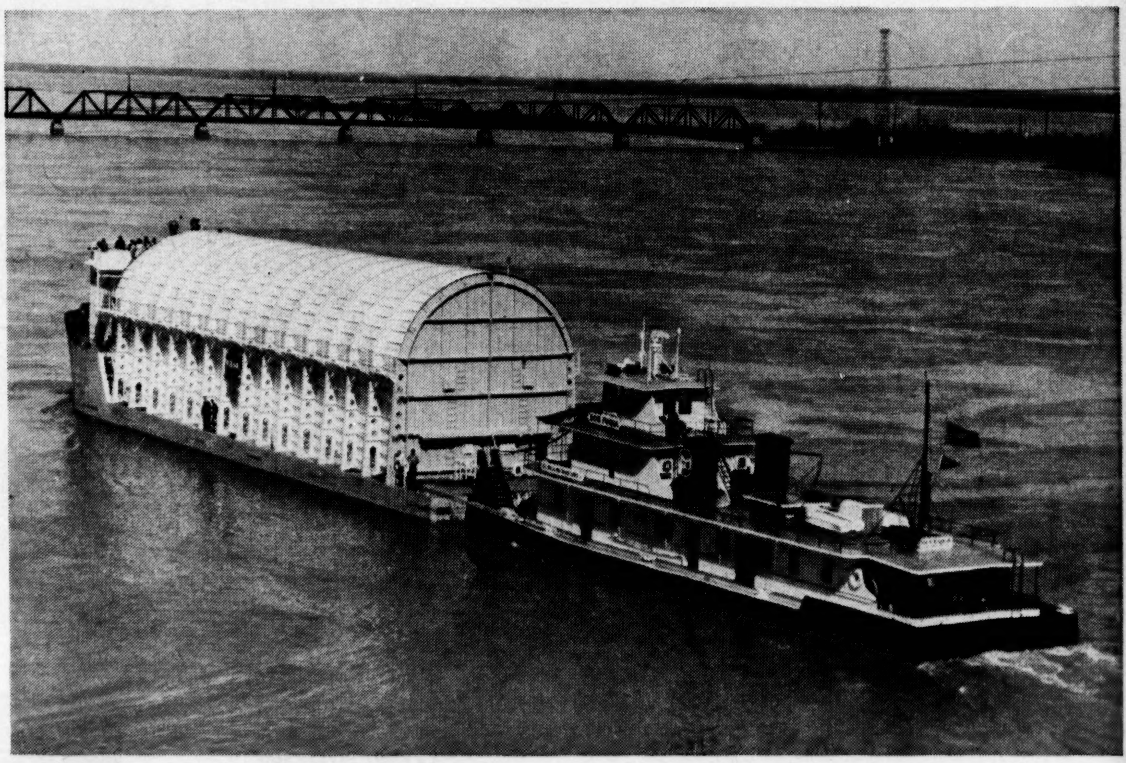
To communicate 99% of the time, satellites required for different altitudes would be: 5,000 mi.—14-18; 4,000 mi.—15-21; 3,000 mi.—18-27; 2,000 mi.—23-35; 1,000 mi.—53 to more than 90.

For their study, the authors based their ground stations in Newfoundland and Northern Ireland, both located at 56 deg. north latitude, 1,920 mi. apart.

Rocket-Launched Balloons To Measure Wind Velocity

Three small balloons will be launched by Deacon Arrow rockets from Naval Missile Facility, Pt. Arguello in a study of wind directions and velocities to altitudes above 300,000 ft. by Sandia Corp., prime contractor to the Atomic Energy Commission.

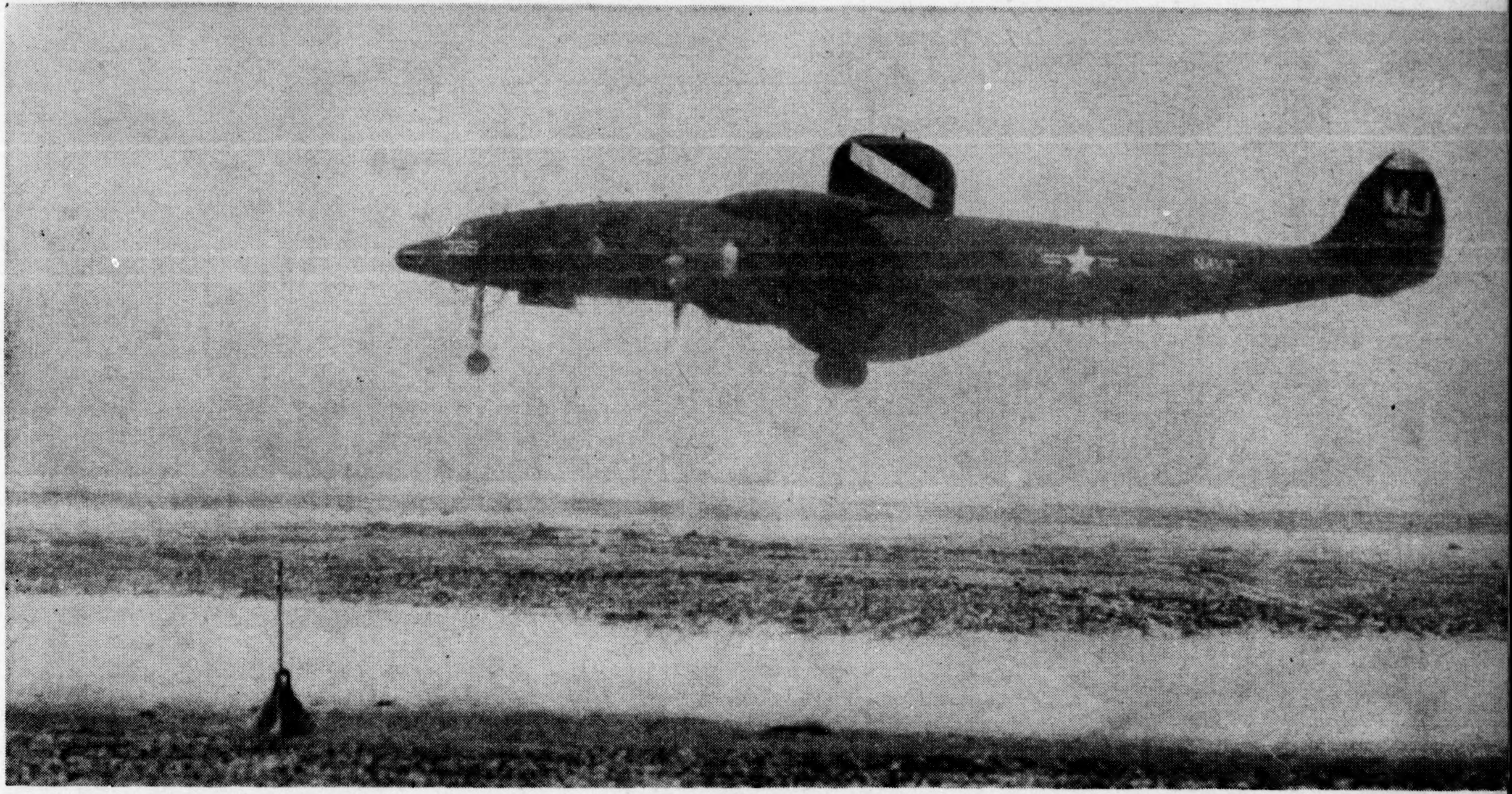
The first of the three launches will occur this month and the succeeding two will be made in April and May. Radars at Pt. Arguello will track the 39-in. Mylar balloons to measure upper atmosphere winds. Deacon Arrow is a 17-ft., two-stage, solid propellant rocket.



Saturn Booster Barge Makes Shakedown Cruise

Barge Palaemon, which will transport the Saturn booster from Huntsville, Ala., to the Atlantic Missile Range, is shown on a shakedown cruise on the Tennessee River. Second trial run will be held in mid-April. First Saturn booster development flight is scheduled late this year, following a 2,200-mi. barge trip from Huntsville to Cape Canaveral.

AERONAUTICAL ENGINEERING



NAVY LOCKHEED WV-2 radar barrier plane encounters typical Argentia landing condition—blowing snow. The aircraft is returning from a 13-hr. mission over the North Atlantic; fuel load for the mission is about 7,200 gal. Plane carries a 22-man crew.

Navy Maintains Barrier in All Weather

By Herbert J. Coleman

Argentia, Nfld.—United States Navy is flying an Atlantic radar barrier line from this remote Newfoundland base on a 24-hr., all-weather basis, despite climatic conditions that often border on the violent.

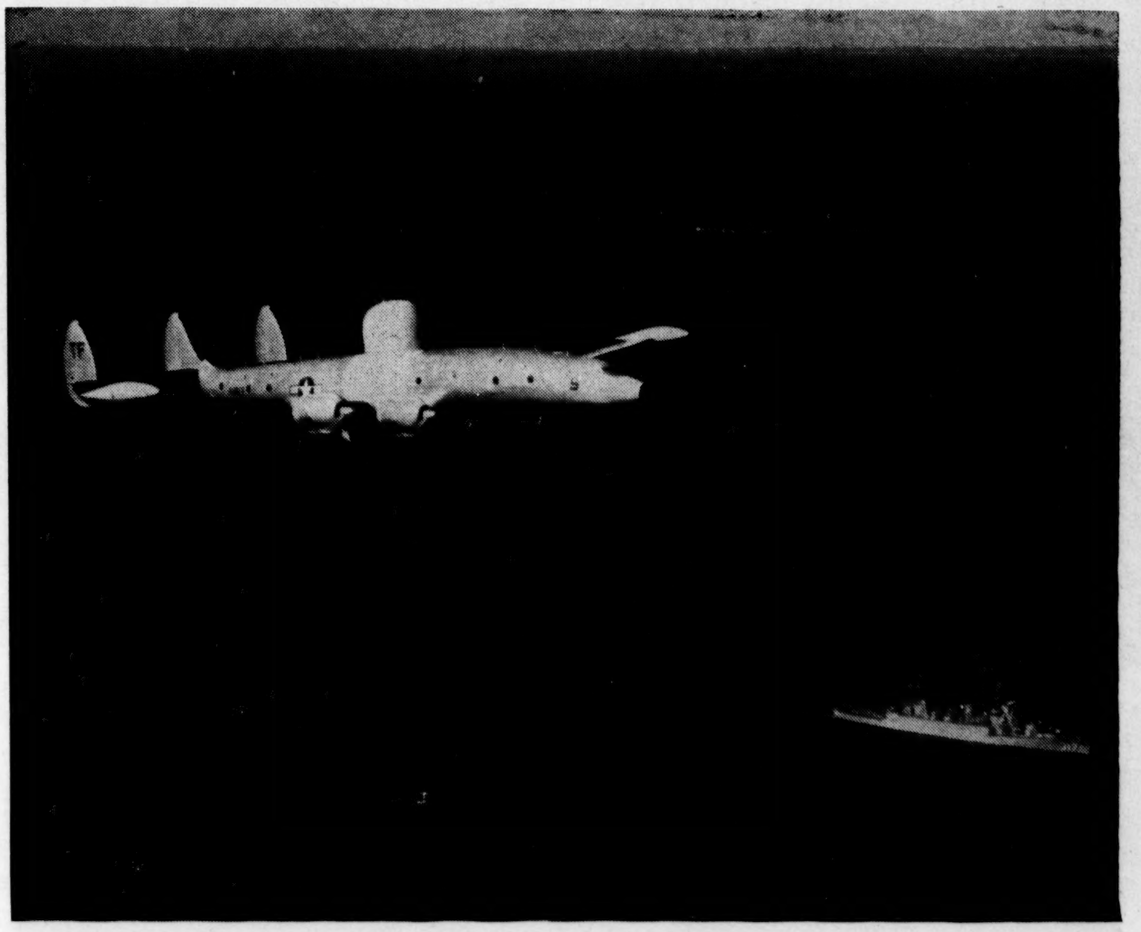
The barrier is an extension of the Dew and Pine Tree Lines, to a point near the Azores. Missions last up to 14 hr. Navy has yet to miss a barrier launch after four years of operations in which only one plane has been lost at sea, and that apparently due to a weather phenomenon.

Fate of the missing plane remains a mystery; there were no survivors and no wreckage was sighted. Radio reports also gave no indication of trouble. But Navy officials suspect that St. Elmo's Fire, often found in electrical storms, may have played a part in the disaster.

Barrier planes frequently encounter St. Elmo's Fire, usually on propeller tips. However, the electrical charge has, in some cases, built to such intensity that ions have formed a fiery ball which ricochets down the corridor from the cockpit to the aft end, before disintegrating. When St. Elmo's Fire shows up on wing and propeller tips, pilots now slideslip the plane in an attempt to lose it.

One other recent loss at sea—a Military Air Transport Service plane—also could possibly be attributed to this electrical buildup. The plane, a C-124, was crossing the barrier, in radio and radar contact with a picket aircraft, when conversation ceased and the blip disappeared. Conditions were right for St. Elmo's Fire, but no survivors or wreckage were found.

Three squadrons fly the barrier run, using Lockheed Super Constellations



CONSTELLATION flies over Navy ships during period of rare good weather along barrier.

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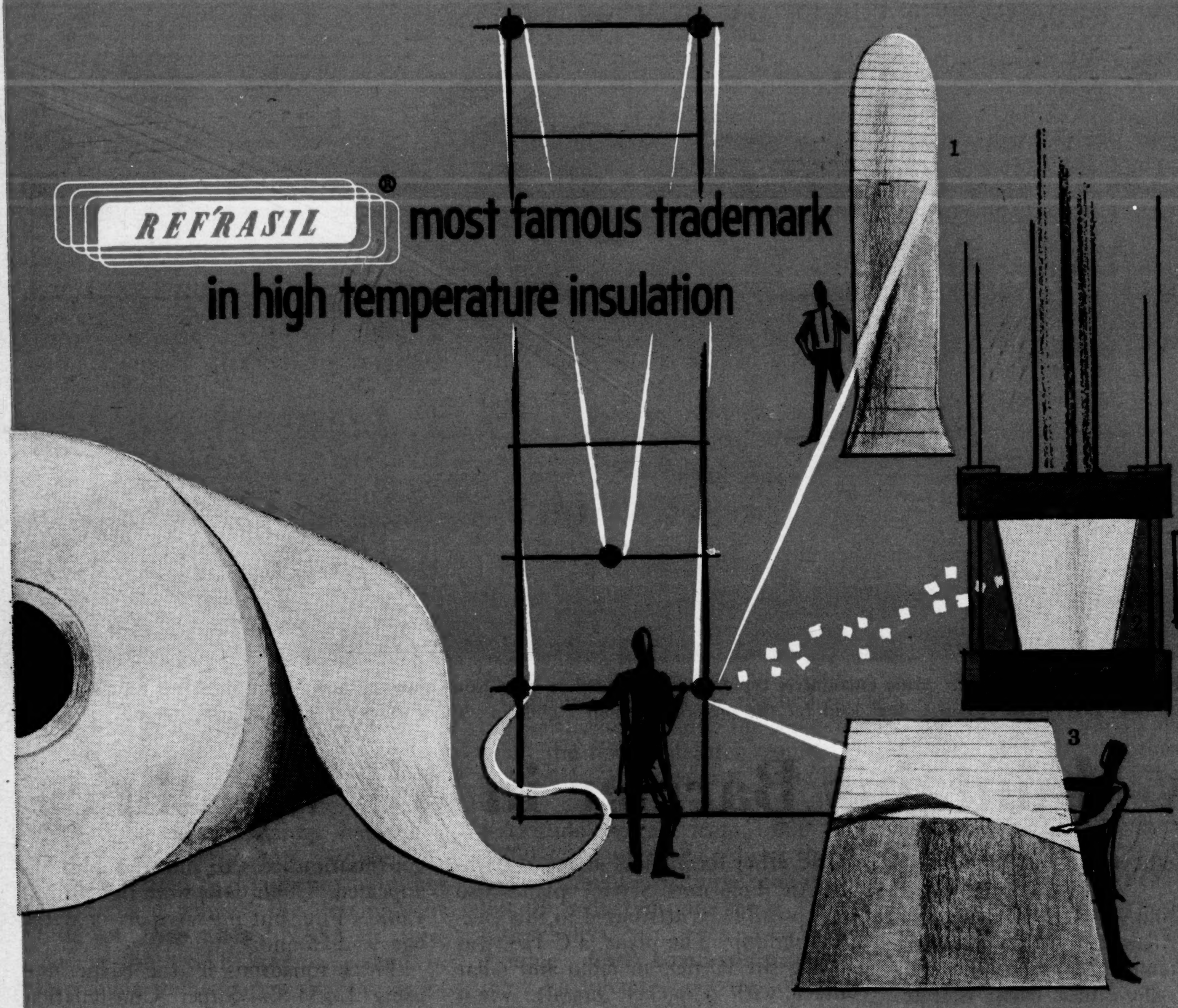

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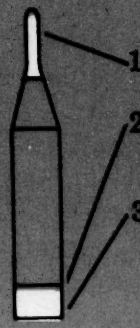

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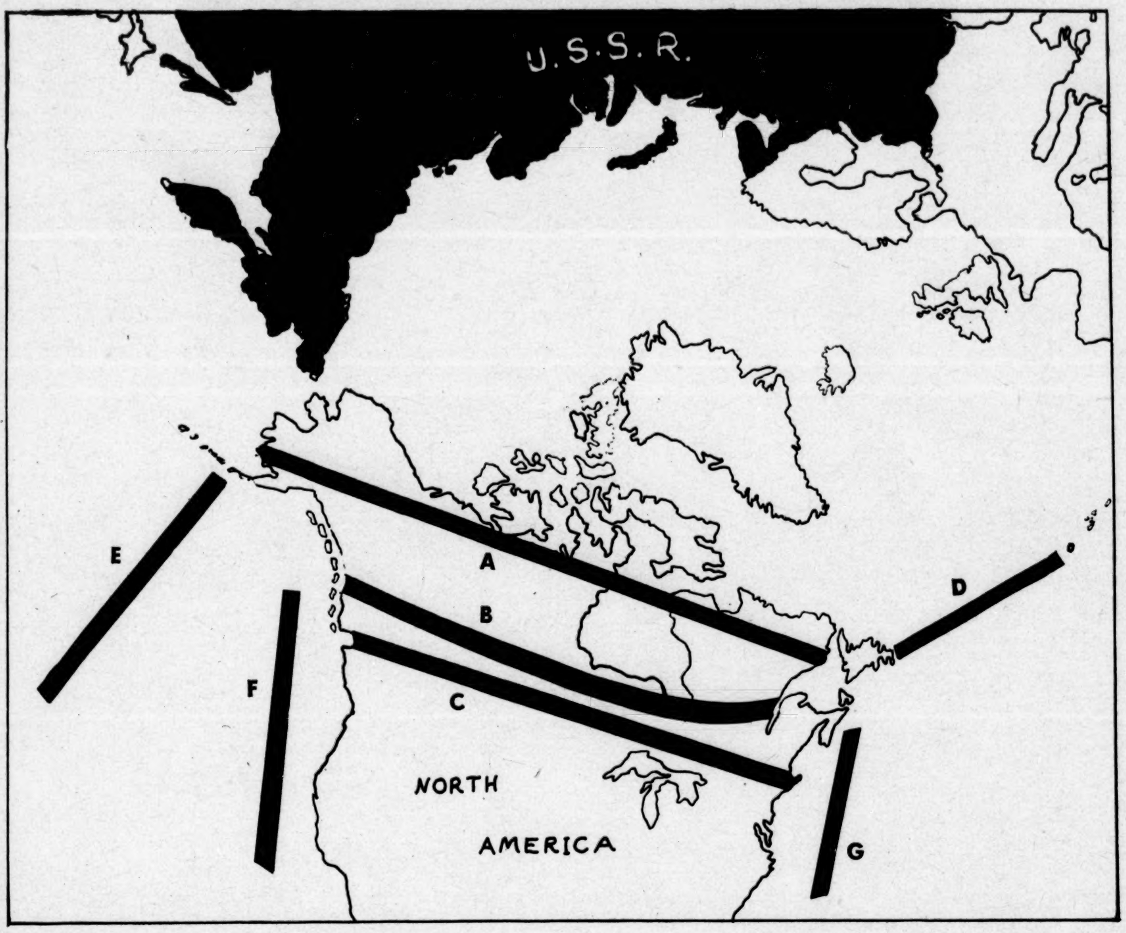

ATLANTIC RADAR BARRIER (D) is the over-water extension of the Dew Line (A); Mid-Canada Line (B), and Pine Tree Line (C). Pacific radar barrier (E) operates out of Hawaii to Alaska; (F) and (G) are Pacific and Atlantic contiguous barriers using ships and Texas towers for radar monitoring.

modified for search and height-finding radars. The plane, with modifications, costs about $6 million. One squadron —VW-11—is based at Argentia and the other two—VW-13 and -15—commute from Patuxent River, Md.

The weather they fly in is best described as foul. High winds predominate and at least on one occasion, a WV-2 Constellation has been launched in a 96-kt. wind. Blowing snow is a constant hazard and icing is ever-present during the flights.

An indication of the flight conditions: pilots set their own takeoff minimums, which are usually visual sighting of at least two runway lights. Not long ago, the barrier force recorded its 10,000th mission when Lt. Cdr. Joseph Rolleri, of VS-11, and his crew of 22 returned to Argentia after a 13-hr. flight.

Navy won't say how many ships are on constant duty along the barrier, only pointing out that surveillance is constant and effective, supplemented by destroyer escort vessels steaming on station to plug any gap.

Argentia is home to more than 3,500 officers and men. Equipment includes a Lockheed P2V squadron, used for ice patrols and reconnaissance, a Coast Guard search and rescue squadron and base support aircraft, with a Beech 18 and a Douglas R5D. Nearest major city is St. John's, 85 mi. northeast. The town of Argentia, comprising 14 houses, a post office and railroad station, is completely encircled by the Navy base.

The barrier first went into operation July 1, 1956. Since that time, the squadrons have flown more than 120,000 operational hours to support the early warning network lines, according to Rear Adm. Robert B. Moore, commander, Atlantic Barrier Forces.

In Washington, Navy spokesmen said negotiations are under way with the Icelandic government to establish a launch station in that country. Planes would be flown there from Argentia.

This Aviation Week editor joined the crew of a WV-2 for a barrier mission that turned out to be typically all-weather for most of the flight. The mission went this way:

With takeoff set for 0400, Crew No. 2 of VS-13, commanded by Cdr. H. D. Fechtelkotter, briefed at 0200. Briefing was mostly for weather, since barrier routes are nearly fixed.

With 12 to 14 hr. of flight in store, weather briefing is ticklish, particularly in the terminal forecast. Argentia weather is subject to change without notice, but on this flight, base weather hit the forecast on the nose.

Navy uses a unique launch system, considering the size of the "Willie Victors." Each barrier plane is kept in its own enclosed bay, in one of six in the base maintenance hangars, or in special alert hangars. Engines are started in the hangar after doors are opened; plane then taxis directly to the takeoff runway, No. 7, a 7,450-ft. runway.

With Lt. Cdr. Stanley Ryder in the left seat, the airplane left the hangar, moving into blowing surface snow that

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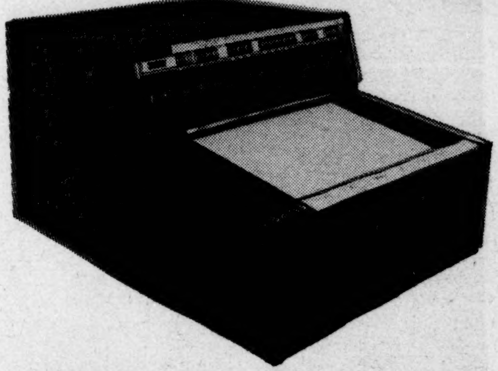

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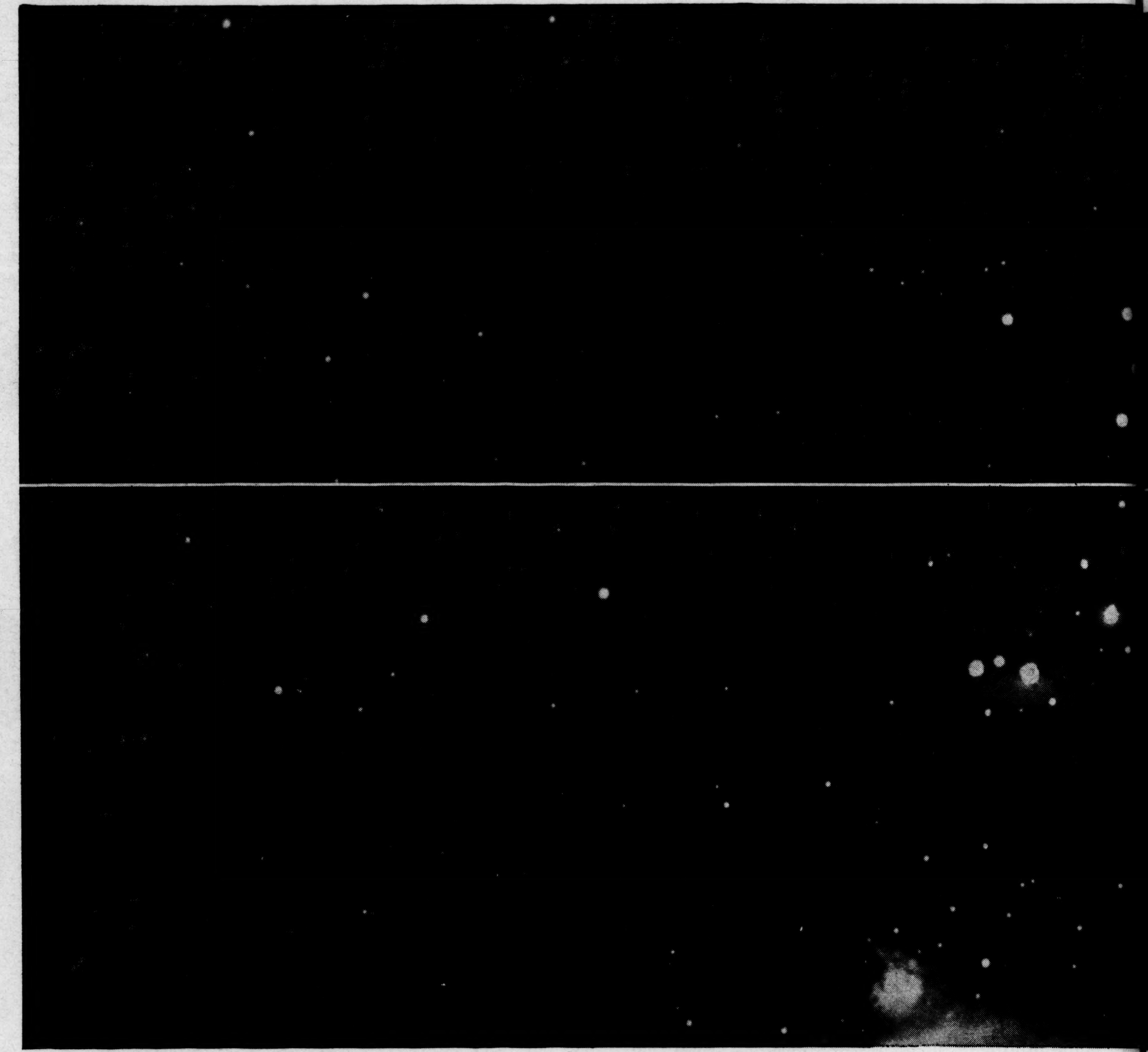

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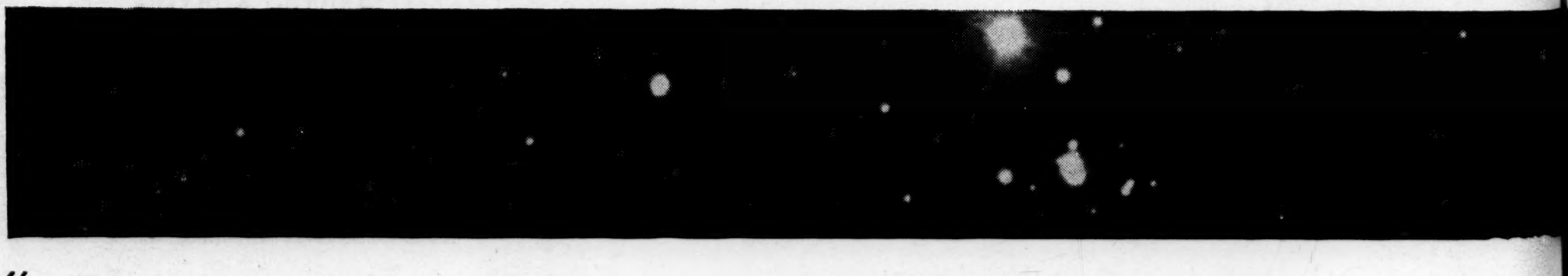

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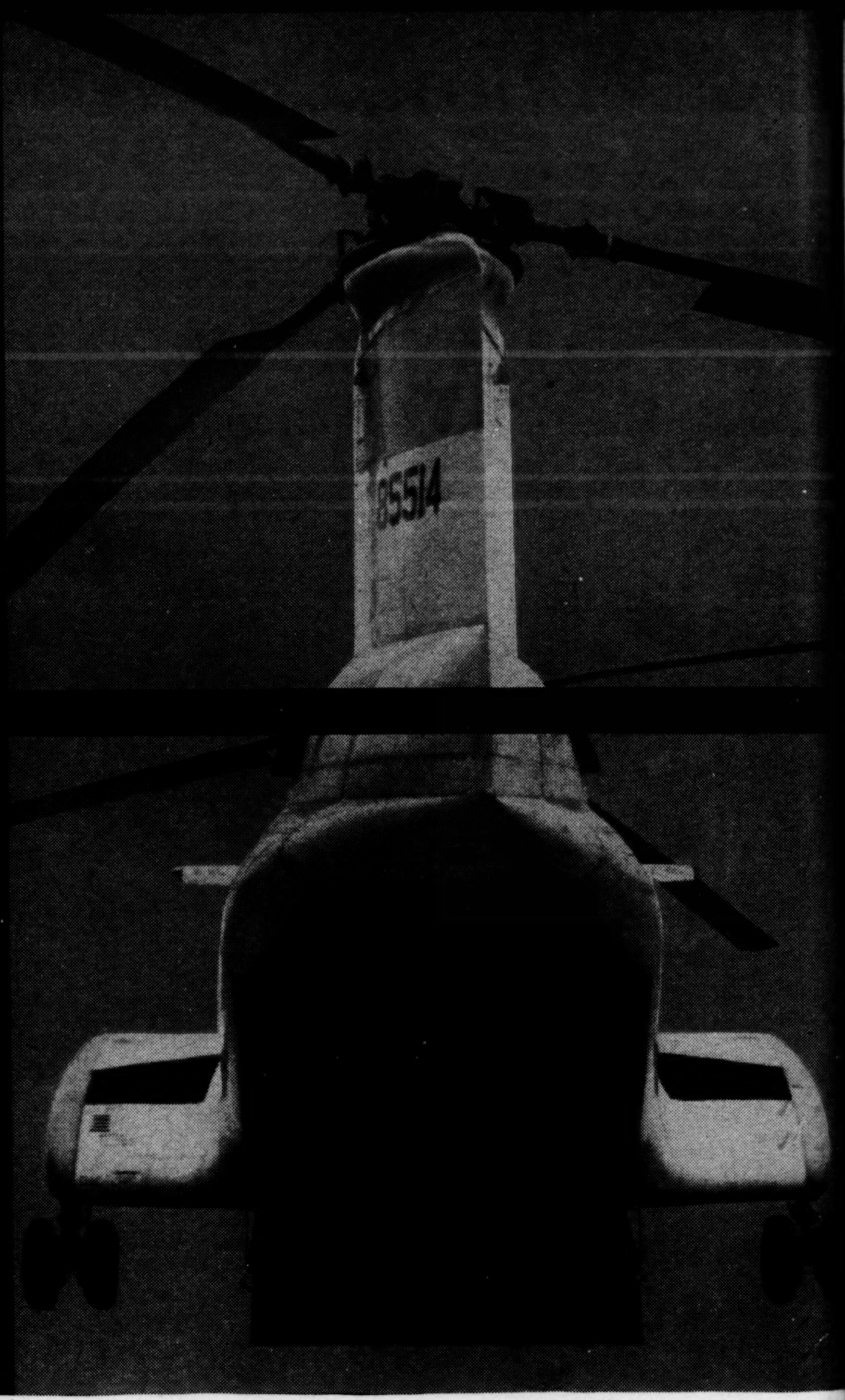
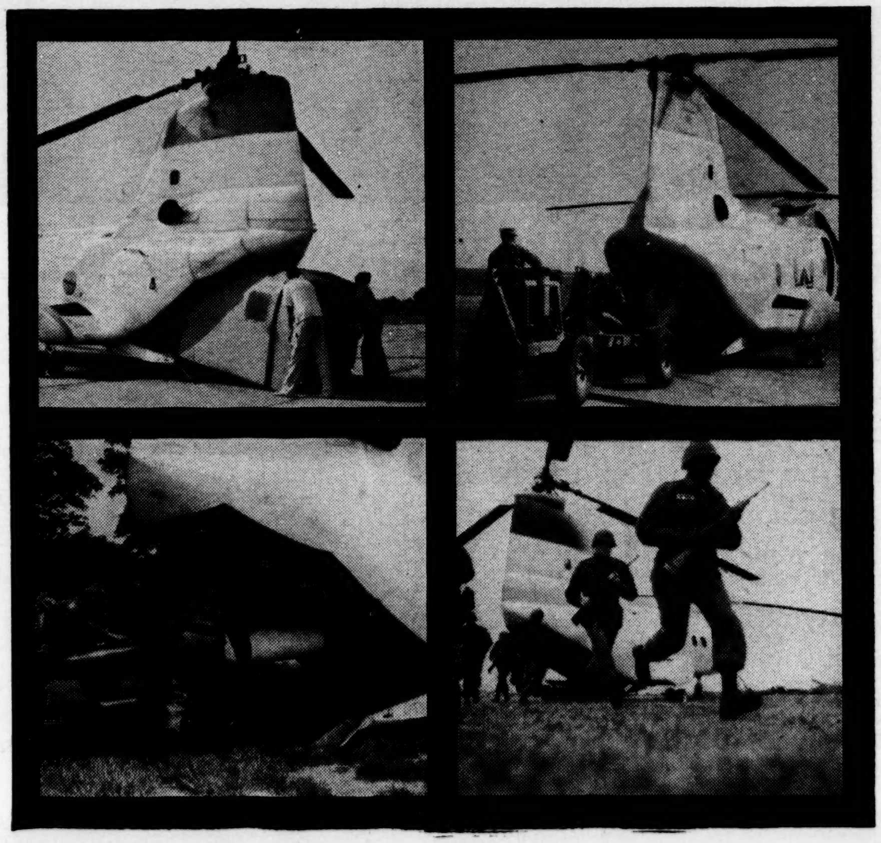


CONVERTS FROM MINESWEEPING TO ASW IN ONE HOUR

The new twin turbine-powered Boeing-Vertol 107 is the only helicopter flying today that can perform so many military missions—without costly conversion of the basic aircraft. The rear loading ramp and unobstructed cargo area permit a variety of modules or equipment to be quickly and easily installed on the 107, thereby enabling it to perform specialized missions for any and all military services. The Navy, for example, can use the Boeing-Vertol 107 for minesweeping and fleet utility duties and then, less than sixty minutes after mission completion, convert to anti-submarine warfare—simply by installing Vertol's ASW module.

Whatever the mission, the performance-proved Boeing-Vertol 107 offers features unmatched by any other helicopter —150 mile-an-hour cruise speed . . . neutral directional stability at zero airspeed for any-wind hovering . . . a Vertol-developed stability augmentation system (SAS) provides fixed-wing aircraft stability which can be augmented with a trim system for automatic flight . . . tandem-rotor design that minimizes down-wash velocities . . . ability to land and take-off from water without special flotation gear.

These are just a few of the capabilities that make the Boeing-Vertol 107 the *first* all-mission, all-service helicopter.



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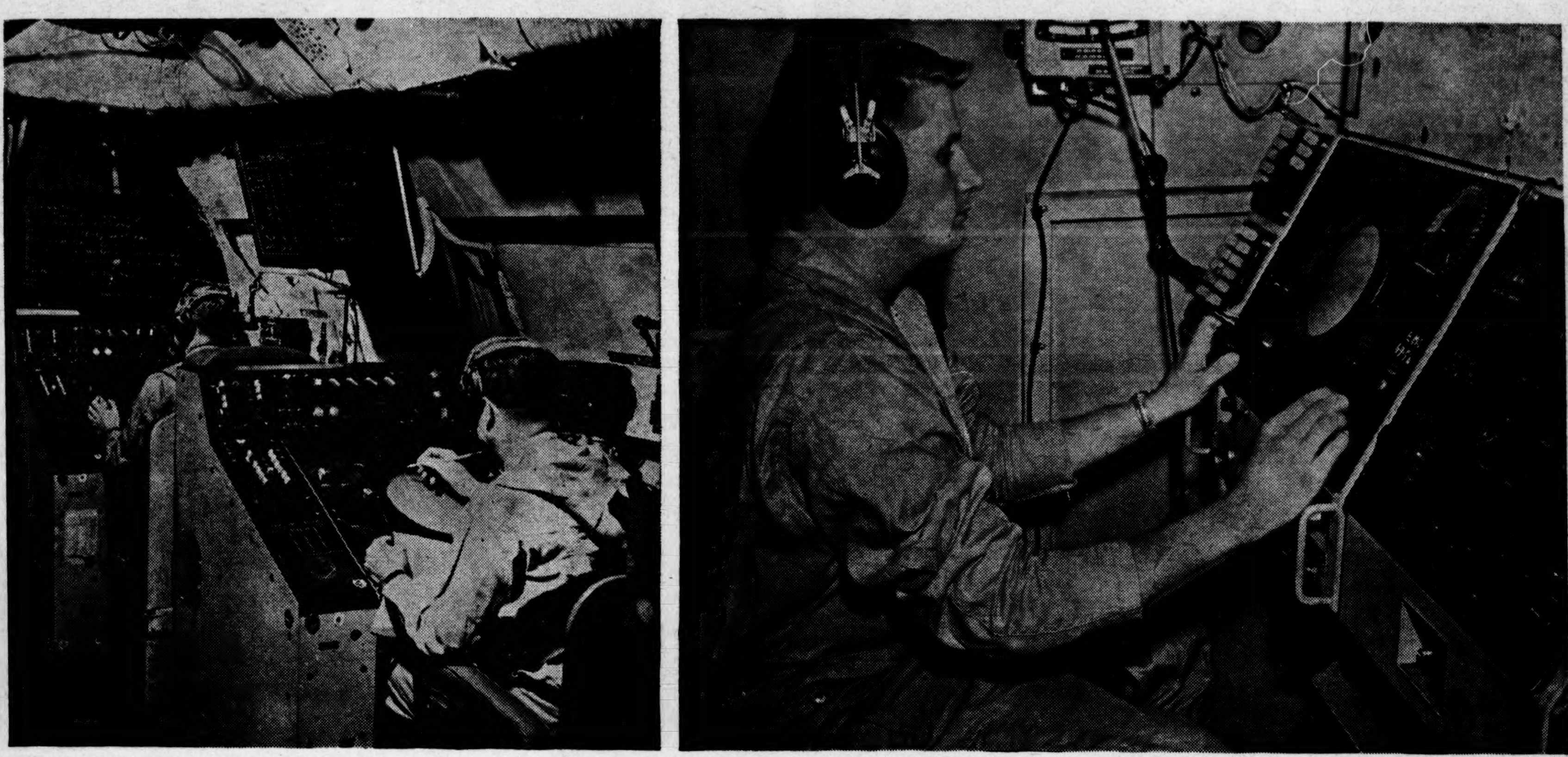


TECHNICIANS aboard the WV-2 man search radar scopes constantly (left). Contacts are plotted in the airborne Combat Intelligence Center and radioed to Operations Control Center at Argentia for evaluation. At right, crew member operates the height-finder scope.

made ground navigation tricky. Ceiling was 500 ft. and visibility about ⅛-mi. in the snow, improving after takeoff. This gave Ryder a look at about half the runway lights when he called for takeoff power.

The Connie reached V_1 and V_2 at 128 kt. and lifted off easily when Cdr. Fechtelkotter called this speed. Ryder was on the gages from takeoff to 6,000 ft. where the Connie broke into the clear. Icing started shortly after the gear came up, but it was rime and most blew away on the climb; boots are installed but were not used.

All barrier missions are flown at comparatively low altitudes, ranging from 5,000 to 8,000 ft.—altitudes compatible with good radar coverage of planes at varying heights. In a typical barrier 48 hr., the WV-2s will make as many as 100 contacts, finding correct height on most of them.

For example, Strategic Air Command attempted a sneak penetration, known only to one Navy staff officer at Argentia. Flying at both high and low altitudes, SAC Boeing B-52s and B-47s made five attempts to cross the barrier undetected. In five cases, they were contacted and tracked by the WV-2s on duty and reported through Navy-Norfolk to North American Air Defense (Norad) at Colorado Springs, Colo.

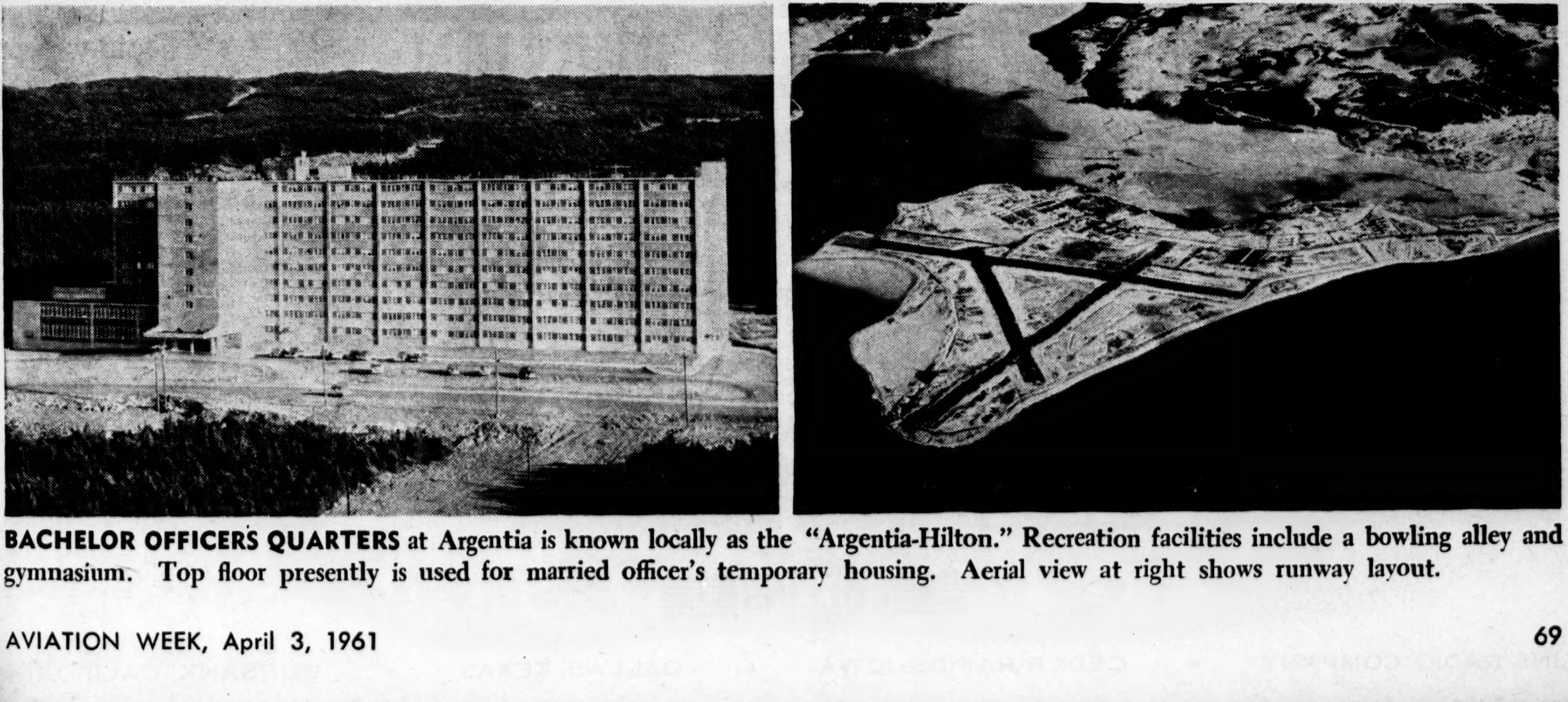
Radar Equipment

The aircraft is fitted with a General Electric APS-20 long-range search radar, mounted in a plastic radome on the belly, and a Philco APS-45 height-finding radar atop the center fuselage. Scopes and repeater units are mounted in a darkened area in the aft section and monitored constantly.

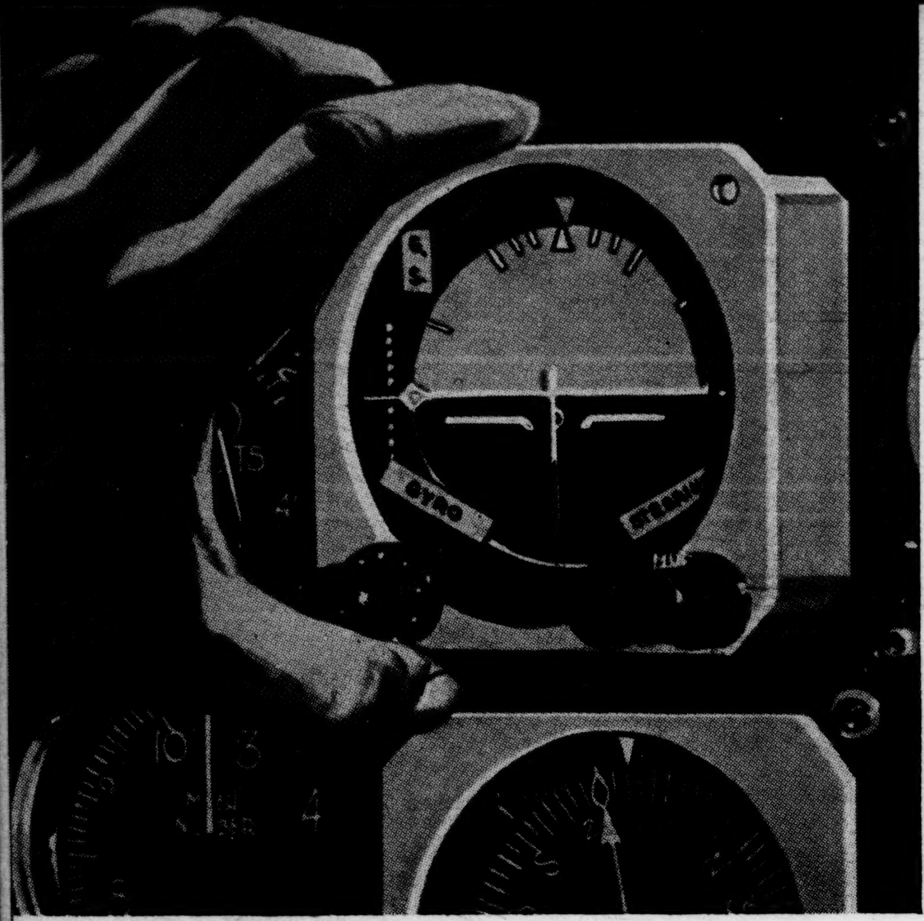
Radar surveillance starts at the barrier gate, where the plane commander sends an "Ops-Ready" signal to the Argentia Operations Control Center which runs a constant plot on WV-2 positions along the barrier. A radar contact, once plotted for course, speed and altitude, is given a "Flash" message priority and is followed up with additional information in a supplementary message.

At Operations Control, the decision is made on whether to consider the contact an "unknown." It is checked against known commercial and Military Air Transport Service flight plans, and if data does not conform, the contact is sent by hot line telephone to Norfolk Control. Norfolk is connected directly with Norad and final decision for a scramble interception is made at Colorado Springs. The scramble can be launched in less than 10 min. from time of the first flash advisory from the WV-2.

Contacts are plotted directly on search and height-finder scope. The flash report, besides immediate transmission to Operations Control, is plotted on a replica of the barrier and

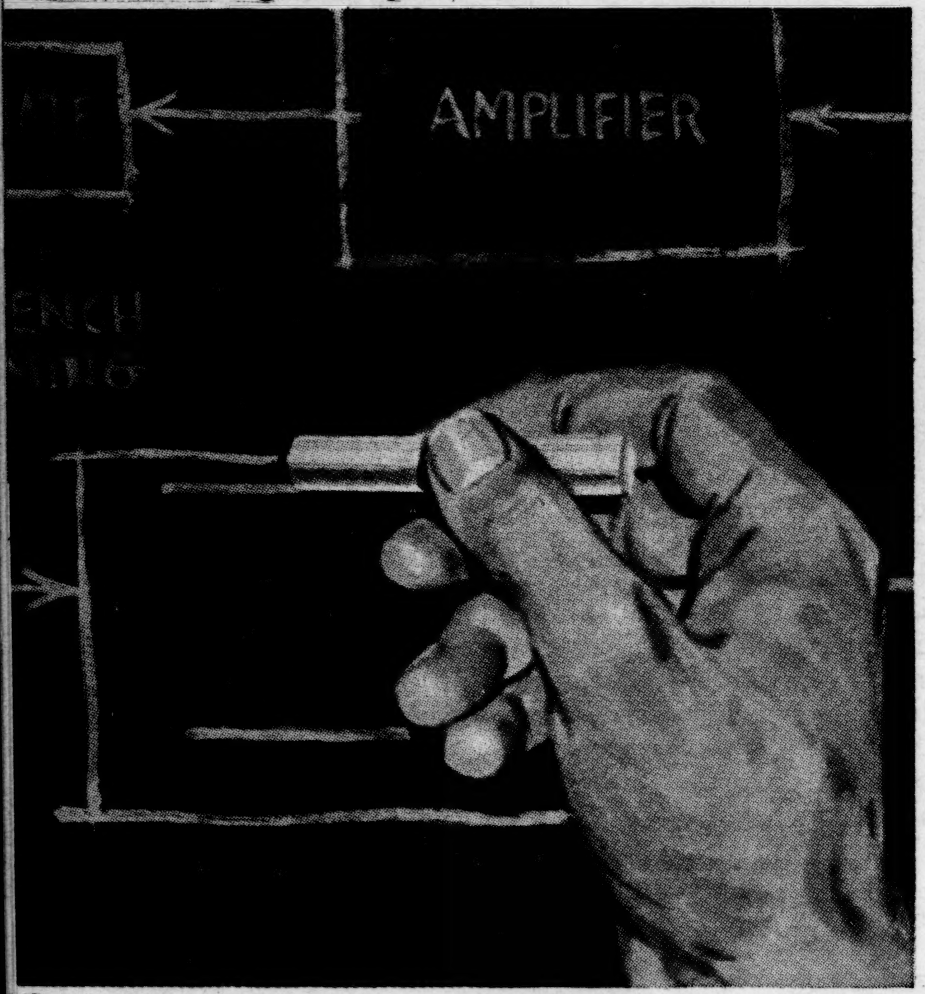


BACHELOR OFFICERS QUARTERS at Argentia is known locally as the "Argentia-Hilton." Recreation facilities include a bowling alley and gymnasium. Top floor presently is used for married officer's temporary housing. Aerial view at right shows runway layout.

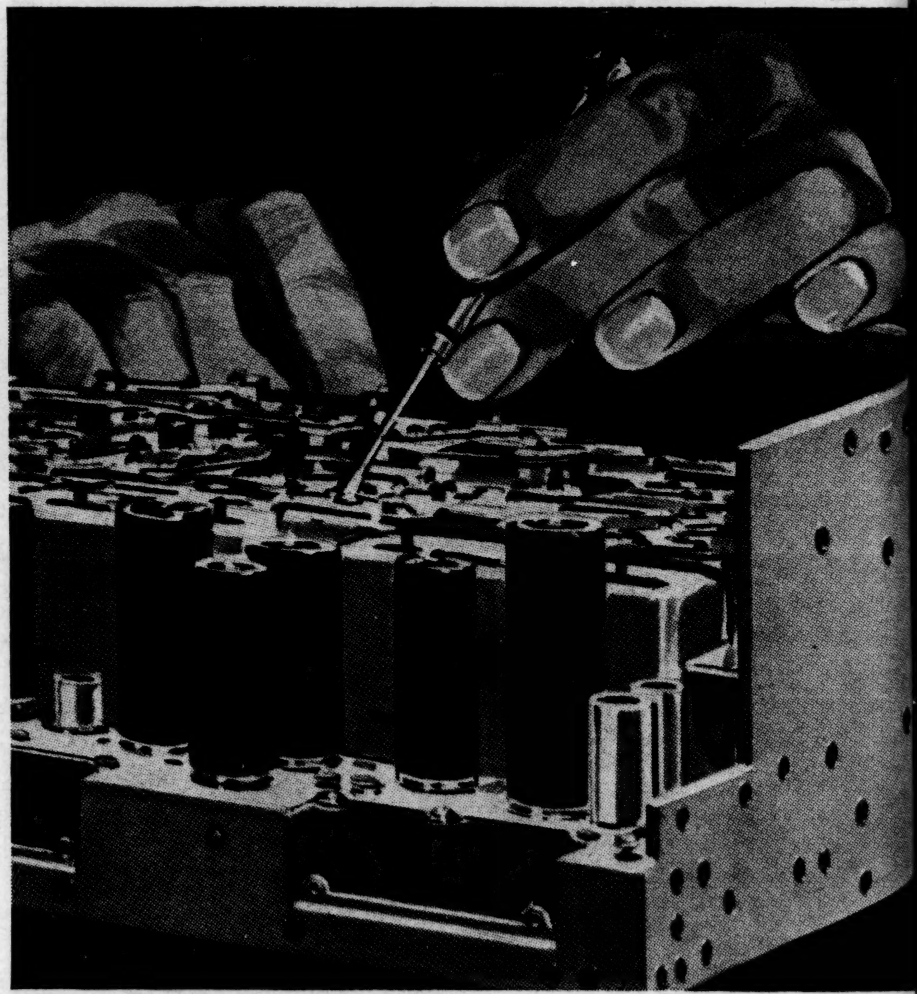


Field Service Engineering

Replacement Parts



Customer Training



Factory Repair and Modification

A NEW COLLINS DIVISION EXTENDS A HELPING HAND

Collins Radio Company's new Service Division is providing Collins customers throughout the world with the finest in maintenance and technical support. Organized to consolidate the service responsibilities of all Collins equipment and systems in use, the Service Division is making a substantial contribution to Collins' goal: maximum reliability and minimum down-time on Collins products.

The Service Division is staffed by specialists in Field Service Engineering, Factory Repair and Modification, Parts Provisioning and Technical Training.

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its course monitored for the entire time the blip is seen. A preset computer also shows the WV-2's position on the barrier.

In addition to radar, the WV-2s carry electronic countermeasures equipment, which evaluates reaction from other radar sets, both airborne and surface. In some cases, the WV-2s have picked up submarine contacts through ECM, and on a previous run, Cdr. Fechtelkotter ordered a low-level reconnaissance run to check out an ECM reaction. It turned out to be from a Canadian trawler, and the crew is still looking for its first submarine.

With such long flights, at almost constant headings for considerable periods of time, the problem of crew boredom becomes primary. To combat this, the crew often interchanges jobs, i.e., the pilots will navigate, navigators man radar sets and the like.

In addition, airborne emergency drills are called without warning. On this particular flight, Cdr. Fechtelkotter ordered a ditching drill when the aircraft was on a GCA approach to Argentia. Ditching was simulated for touchdown and the crew was well into position. Actual abandonment, carrying designated survival equipment, was made in the alert hangar. To ensure competence, Navy keeps an evaluation team at the ready to pull spot checks on various crews. The team usually shows up at briefing time without advance warning.

This particular barrier run was made in a counterclockwise direction and the turn was made at a point near the Azores, where Lajes is the launch base in case a barrier plane is "looped" off the barrier for landing. This happens when weather conditions are extreme at Argentia, or in isolated cases when a crew is looped into Lajes for rest and recreation, of which there is little at Argentia and not much more at Lajes.

The loop is worked out by Operations Control and when the crew commander leaves Argentia, he never knows exactly when he will be back; the 22-man crew carries complete clothing changes on each mission.

Once airborne, the crew's duties are rigidly controlled to allow each man proper rest, particularly in the radar section where scope scanning can be mentally exhausting. The WV-2 has a well-equipped galley and at least one hot meal, prepared at Argentia, is served in shifts. The coffee, in Navy tradition, flows constantly.

About 12 hr. after takeoff, Cdr. Fechtelkotter was relieved from the barrier and headed inland for a GCA approach, a common occurrence. Ceiling was about 400 ft. and visibility about 15 mi., but the crew again had to put up with another common weather problem—icing on the run-

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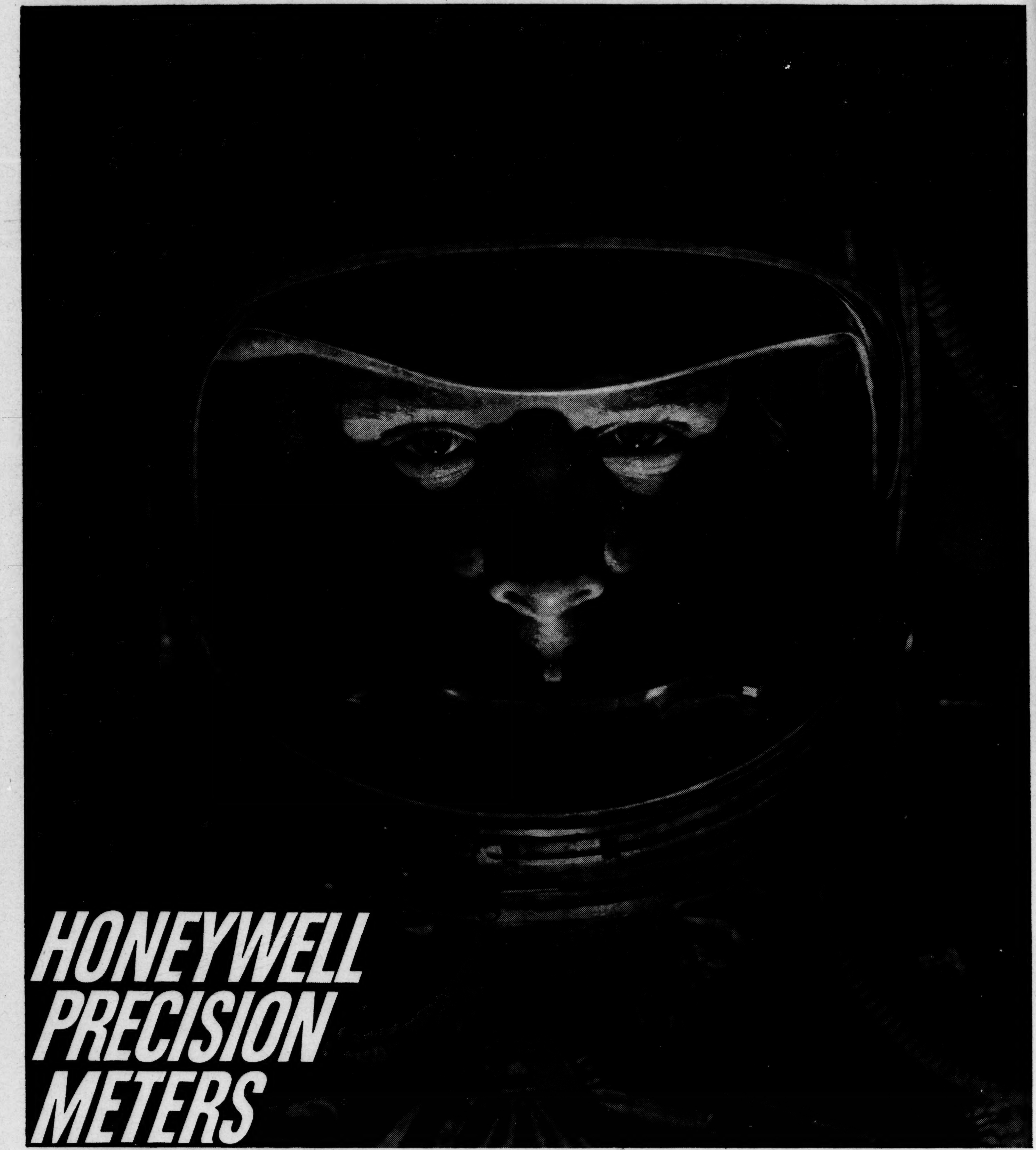

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ways. The Constellation is fitted with propeller reversing and, despite the ice, stopped well short of runway's end.

Debriefing showed that Crew No. 2 had made 17 contacts, of which height finding was obtained on 11. A check with Operations Control showed that the 17 contacts worked out to 100% observation by WV-2; those were airplanes substantiated by contacts from other WV-2s and surface vessels.

The WV-2 was taxied directly into its hangar bay, where VS-13 maintenance crews checked the flight report for snags. No major maintenance is performed here, but spare engines are available and can be installed in short order. Maintenance on 100-hr. inspections is performed on planes assigned to VS-11, the Argentia squadron, and the Patuxent River squadrons rotate their planes back to home base for 100-hr. checks there.

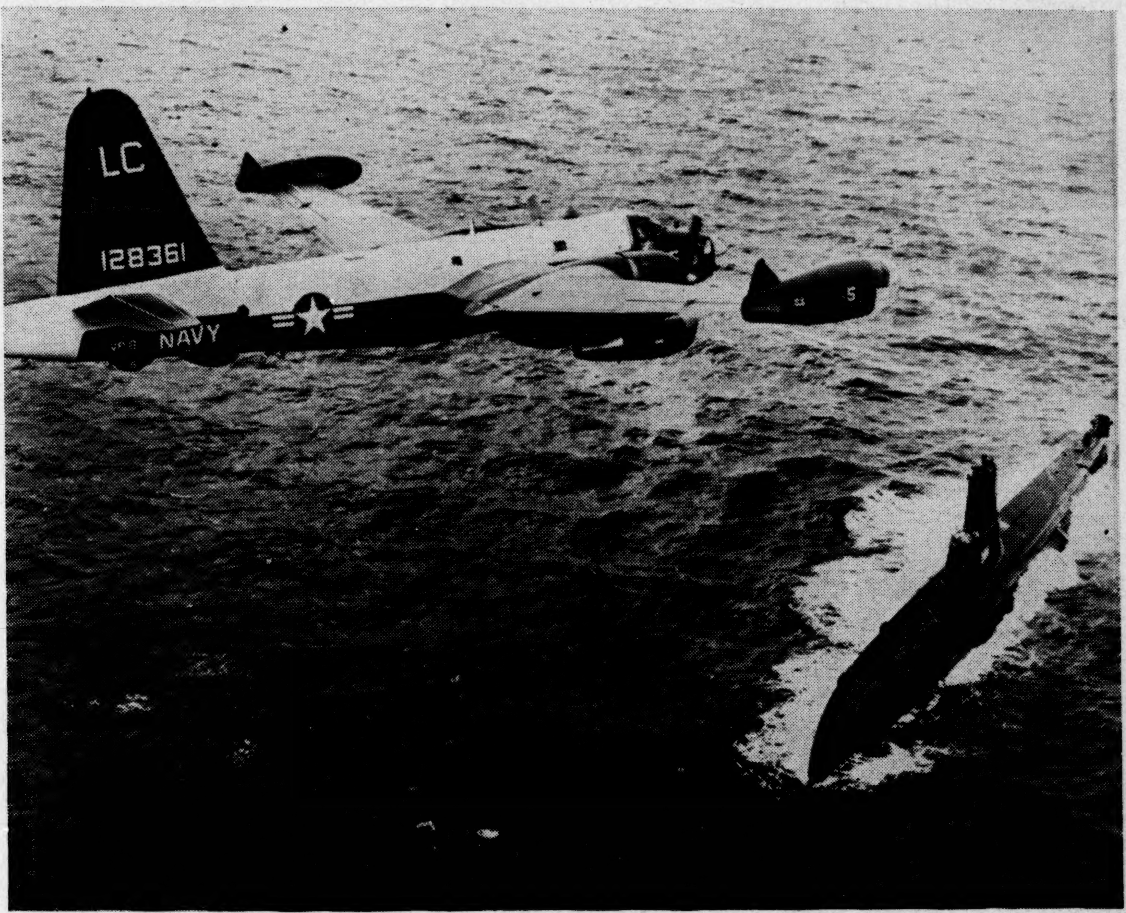
However, all WV-2s are sent to Lockheed Air Service, Inc., at New York's Idlewild Airport, for 400-hr. checks, run on what Lockheed calls an "equalized maintenance plan," first developed for commercial air carriers. This allows a complete inspection cycle to be performed in 7,200 hr., with airplane downtime kept to a minimum. The 400-hr. inspection takes from 7 to 10 days and the plane is returned to service at Argentia.

So far, Lockheed Air Service has provided two-million man hours of maintenance service; a considerable amount of this is spent on avionics gear, of course. At specified times, at Navy request, Lockheed performs an X-ray inspection of stress points to detect possible damage. This is of particular value because of corrosion factors which enter into the Argentia operation, in all-weather flying.

Before a crew assignment, extensive training is conducted at Patuxent River. A crew commander, for instance, must have 1,000 hr. multi-engine time and 250 hr. in WV-2s before getting a barrier assignment. As things work out, crew commanders usually have 5,000-8,000 hr.; in each operational squadron, most first pilots are of commander rank. Each must have a green instrument card (2,000 hr. total time, plus five years rated service).

Although barrier flights are the primary mission at Argentia, there are a number of other duties. The P2V squadron flies extensive ice patrols, under international agreement, as an aid to shipping, primarily in charting flow of icebergs.

Another facet of this mission is surveillance and plotting of surface vessels; there are often as many as 2,000 operating in the patrol area, and many of them are Russian trawlers of the Pushkin and Mayakosky class of fishing and supply vessels.



LOCKHEED P2V, one of 11 based at Argentia, works with Royal Canadian Air Force in checking surface vessels and ice flow. Canadians used the Canadair Argus.

The P2Vs also have sighted submarines of the Soviet "Z" class, which possibly carry two missiles in the aft conning tower. On sightings, the submarine crews cover that section with canvas if the sub cannot dive before aerial inspection.

The 11-plane P2V squadron usually operates at low level, again in all-weather conditions. Major hazard, besides the weather, is colliding with icebergs—measured as rising nearly 300 ft. above surface of the water.

Argentia has a single Sikorsky HUS helicopter, used mainly for search and rescue. In recent weeks, the aircraft has been used to aid civilians trapped in rugged terrain by snow and ice. On one mission, the HUS flew 10,000 lb. of food to an isolated community in danger of starvation. Later, a man and two children, all critically ill, were flown from Isle Valen and Petit Forte to Placentia Cottage Hospital, Placentia, Nfld., within two hours of notification.

PRODUCTION BRIEFING

Lear Electro-Mechanical Division has won a $4-million contract to continue production of engine inlet and flap systems for shock wave control on Republic F-105 aircraft. Contracts for the systems now total $15 million.

General Electric Missile and Space Vehicle Department has an $18,000 Navy contract to produce one water recovery system able to produce potable drinking water from human urine.

The Avco-Everett Research Laboratory has been awarded a $325,000 letter contract by Bell Telephone Laboratories for an experimental study of a decoy discrimination system for the Nike Zeus anti-missile missile. The study will center on means of identifying the characteristics of radiation emitted from objects re-entering the atmosphere and the development of optical sensing apparatus.

Simmonds Precision Products, Inc., Tarrytown, N. Y., has received more than $1 million in contracts for fuel gages for the Convair 990, Sud Caravelle, Lockheed P3V-1, Chance Vought F8U-2N and Canadair CF-104.

First Mexican-produced Lockheed Azcarate utility plane has made its initial flight at San Luis Potosi plant, 200 mi. north of Mexico City.

Republic Aviation Corp. has been awarded a $176,000 Air Force contract for the development of extrusion processes for titanium metal.

Chrysler Corp. has been awarded a $939,278 contract for field service and maintenance on the Army's Redstone missile. The work will be performed at Chrysler's Michigan Ordnance Missile plant, Stirling Twp., Mich.

Baird-Atomic, Inc., Cambridge, Mass., will conduct a reliability testing program for the Missiles and Space Division of Lockheed Corp. in connection with the Midas satellite program under terms of a $2-million contract.

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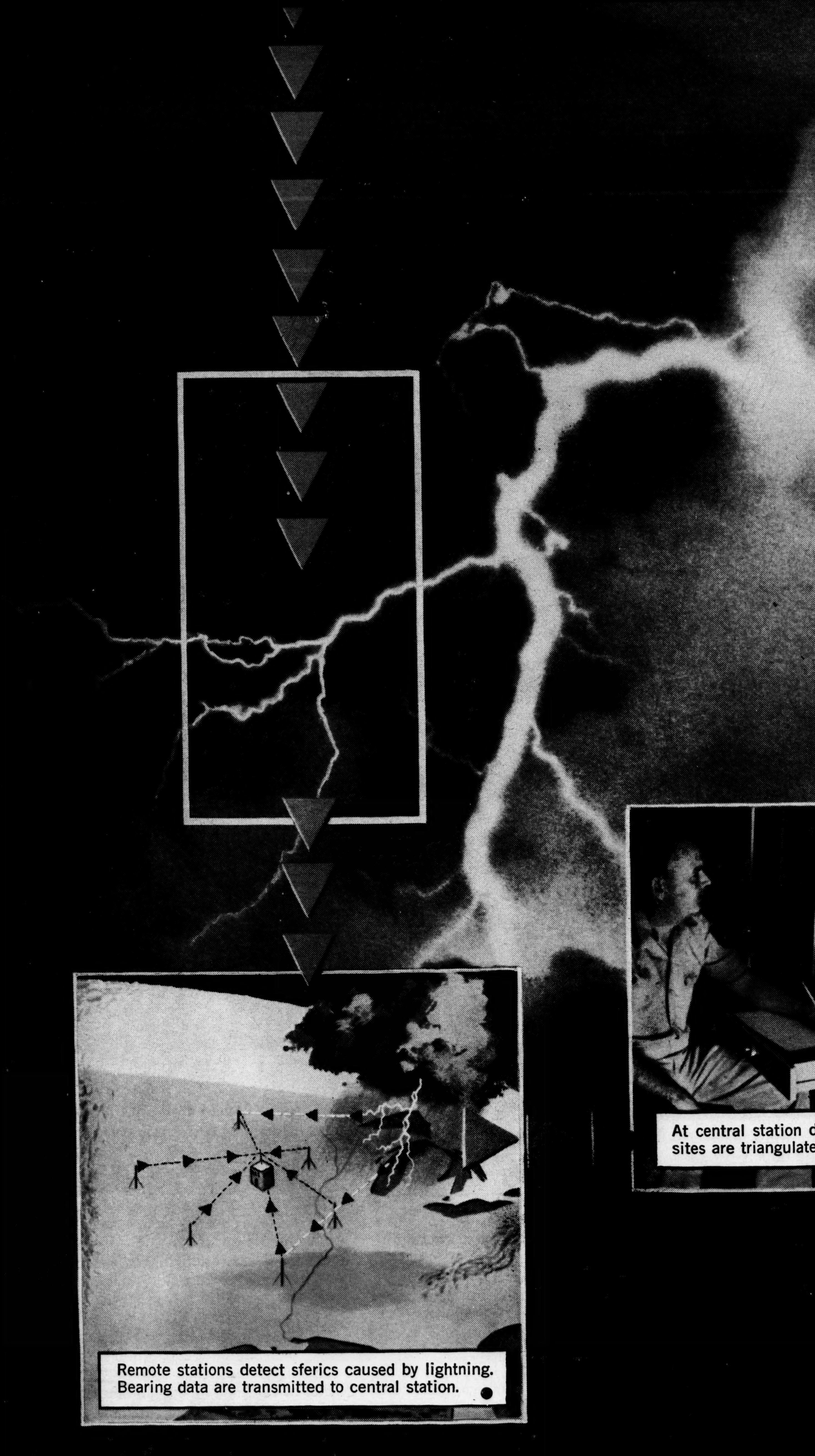

Remote stations detect sferics caused by lightning. Bearing data are transmitted to central station.

At central station d
sites are triangulate

Flashes of light
on kinescope
indicate lightning's location.

tation data from remote
angulated and displayed.

Now... Forecasting by Lightning

New Lockheed Electronics weather system spots storms up to 2,000 miles away

When a storm is brewing, lightning may send warnings hours before it is detected by weather radar. Lightning flashes (sferics) give valuable clues to weather conditions, but until recently, weathermen had no effective way of detecting and locating sferics at long range.

Now, Lockheed Electronics has produced, in conjunction with the Army Signal Corps and Air Force, a unique system that pinpoints all lightning flashes within a 4,000-mile area.

Remote antennas pick up radio signals generated by sferics. Processing equipment converts the signals into directional data and transmits the information to the Air Force's Severe Weather Warning Center in Kansas City, Missouri. There, after triangulation, the signals are traced on a display which gives the storm's location and path.

Continuing research is leading to use of sferics as an aid in forecasting tornados and for plotting severe storms in mid-ocean where present forecasting devices cannot be used.

LEC is contributing importantly in a variety of ways to development of equipment to advance meteorological knowledge. Among current projects are high performance radiosondes and wind data conversion systems.

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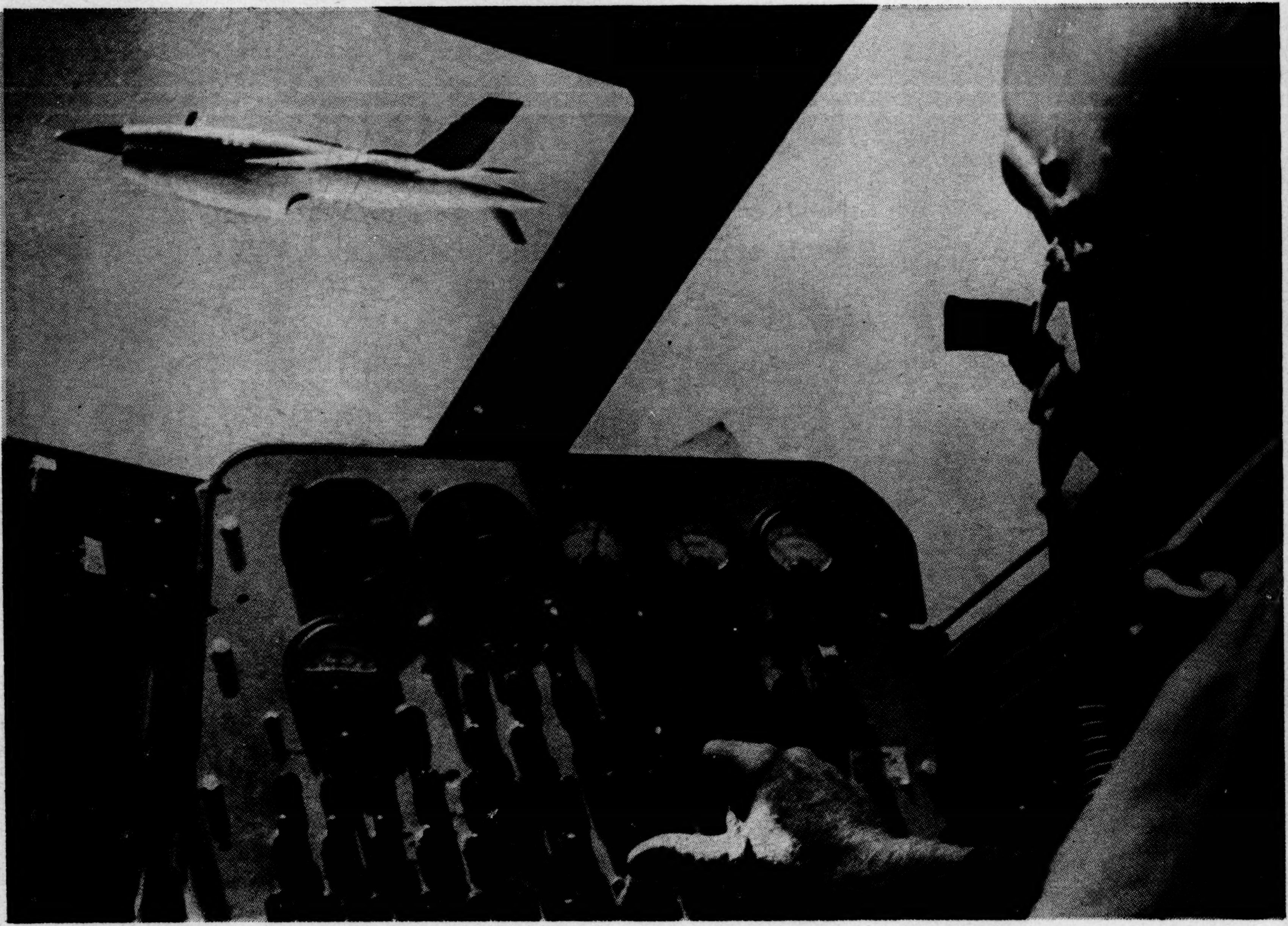
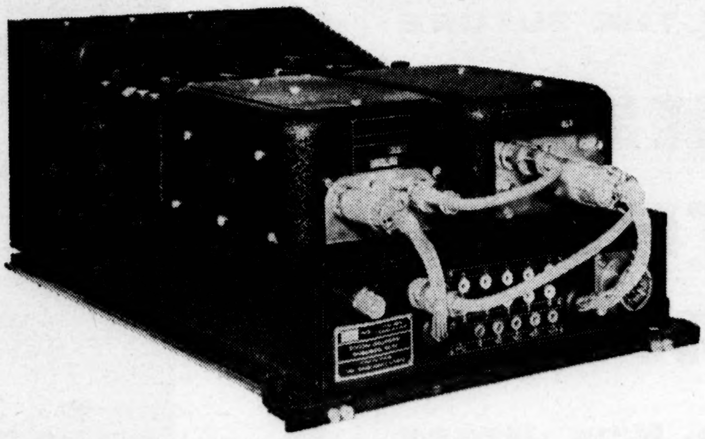


Firebee is precisely maneuvered by remote controller as he receives flight data transmitted from Dorsett telemetry system in the drone.

Ryan uses airborne telemetry systems by DORSETT



Near-sonic, Ryan's Q-2C "Firebee" Target Drone provides a fast, high-flying, evasive target simulating combat tactics. Rugged and recoverable for reuse, the "Firebee" is daily putting the "test of fire" on American airborne and surface-to-air missile systems.

Firebee can be precisely controlled from airborne or ground stations, since in addition to radar tracking data, engine r.p.m., airspeed and altitude are telemetered continuously to the controller by the Dorsett Model TM-4-31 system.

When additional data is required for missile development programs and special applications, the system may be expanded to a total of ten subcarrier oscillators in the pre-wired chassis.

The Firebee telemetry system is one of the many designed and built by Dorsett Electronics. Put Dorsett's experience to work for you on your next telemetry requirement. Your inquiries and specifications will receive a prompt reply.

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AVIONICS

Non-Semiconductor Format Guides Set

By Barry Miller

New York—Another important step in deriving a set of compatible formats for microminiature avionic components was taken here recently at a meeting of system designers who will be specifying this new generation of components for future avionics/space digital data processing systems.

The meeting was the final one under its present name for the year-old Subcommittee on Microminiature Components of the Electronics Industries Assn. (EIA). In recognition of the anticipated widespread use of microminiature components, EIA has elevated the subcommittee to the status of an advisory committee on user recommendations for discrete microminiature components.

At its current meeting the committee hammered out a recommended set of formats for non-semiconductor components. At an earlier meeting (AW Sept. 5, p. 90) it had agreed to similar formats for semiconductor devices. These recommendations—which, the committee stresses, are not standards as such—are to be submitted for study by appropriate industry groups for possible adoption as future standards.

Monitored closely by component manufacturers, earlier actions by the group have elicited favorable responses from several component parts makers. A number of them who were in the process of introducing lines of micro components adjusted their component formats to conform with the subcommittee's desires.

Committee Members

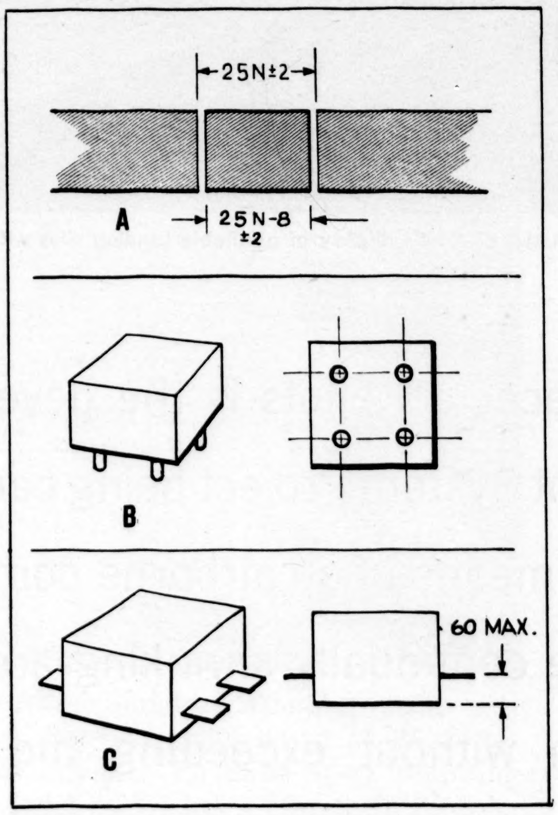
Presently, the committee comprises representatives of a broad group of aerospace systems manufacturers—including American Bosch, AC Spark Plug, General Electric, Ramo-Wooldridge, Litton, Lockheed, Burroughs, Autonetics, and Convair—which originally had the task of developing recommendations for component formats consistent with the needs of projected digital data processing systems. In the future the composition and scope of the committee will be enlarged so it can make user recommendations for microminiature components to be used in other fields such as controls and communications.

Digital systems engineers who have been participating in the group's deliberations during the past year are anxious that future microminiature components which they will need will be available in uniform formats from sufficient sources so the user can be assured of quantity supplies of given components in the correct sizes and shapes for compact, lightweight avionic systems. It has taken the component industry years to advance the formats of the several conventional types of components used in any given field—such as digital data processing—to the point where the size- and weight-savings of one type of component are not overshadowed by the larger volume and weight of companion components.

An important probable consequence of the use of recommended formats will be in automated assembly.

Similar sizes and shapes for a variety of components such as transistors, diodes, resistors, capacitors and inductors, might considerably simplify any efforts to automate assembly of avionic systems.

The recommendations as discussed at the recent meeting are to be incorporated in a complete report which will be presented for the group's approval at its next meeting to be held in Los Angeles during the Western Joint Computer Conference in May. There appeared to be a consensus among members present on the following points, among others:



TENTATIVE uniform formats for non-semiconductor micro components recommended by committee of systems engineers. Packages for resistors, capacitors and inductors are not to exceed 60 mils in height and should be integral multiples of 25 mils in other dimensions. Package is shown in hole of circuit board (A). Pin locations and dimensions of single and double-ended pulse transformers (B and C) would conform to 25-mil grid system also.

- **Uniform passive component format**—A uniform format for micro resistors, capacitors and inductors suitable for insertion into holes in a printed board or a substrate is desired. Components will be a maximum of 60 mils in height and integral multiples of 25 mils maximum in length and width or diameter. Where leads are employed it is suggested that they be ribbon-shaped and coplanar with the top surface of the component. Two-mil tolerances would be permissible on the components and an eight-mil tolerance between a component and the hole is anticipated to encourage capillary action during soldering.
- **Capacitors**—High-use parts will range in value from 27 to 1,000 picofarads and from 0.01 to 2 microfarads. Working potential should be 50 v.d.c.
- **Resistors**—Values desired will range from 100 ohms to 150,000 ohms with the high-usage values expected to be between 2,600 and 6,800 ohms. Electrical characteristics are not to change more than 5% in a 100C temperature change. Frequency limit for resistors is to be 10 mc. minimum. Power rating specifications to be supplied by the component maker should provide information about the maximum temperature limit of the component for a given figure of reliability.
- **Peaking coil inductance**—Coils will be needed in values up to 75 microhenries.
- **Pulse transformers** (lead type inductance)—Single-ended pulse transformers with lead or pin terminations for insertion through holes in a printed circuit board should have dimensions and lead locations compatible with a 25-mil grid system. Double-ended pulse transformer structure intended for partial submersion into a substrate or board hole should have tabs. Maximum depth from one surface, coplanar with the leads, to the leads should not exceed 60 mils.
- **Connectors**—Extensive specifications were outlined for connectors and these will be supplemented by additional data to be obtained from another EIA subcommittee concerned specifically with connectors. All dimensions are to be referenced to the 25-mil grid system including center-to-center distances on contacts, body dimensions and mounting dimensions. Ratings for contacts on 100-, 50- and 25-mil centers are

Computer-operated laboratory model of pilot's display of available landing sites within the realm of safe re-entry.

FAST THINKING for spacecraft pilots is the development objective of the Bendix Energy Management System Project being carried out for WADD, ARDC, United States Air Force. By means of an airborne computer-operated electronic display, a pilot will see the continually shrinking area of targets and landing sites which he can reach without exceeding the acceleration or heating constraints of safe flight. Career opportunities in such advanced projects are available to engineers who would like to direct their energies most effectively.

BENDIX SYSTEMS DIVISION
ANN ARBOR, MICHIGAN

THE Bendix CORPORATION

0.5, 0.4 and 0.3 amp. minimum and 0.02, 0.03 and 0.04 ohms maximum, respectively. Voltage breakdown between contacts should not drop below 100 v. rms for the 25-mil centers, 150 v. rms for 50-mil centers and 200 v. rms for 100-mil centers.

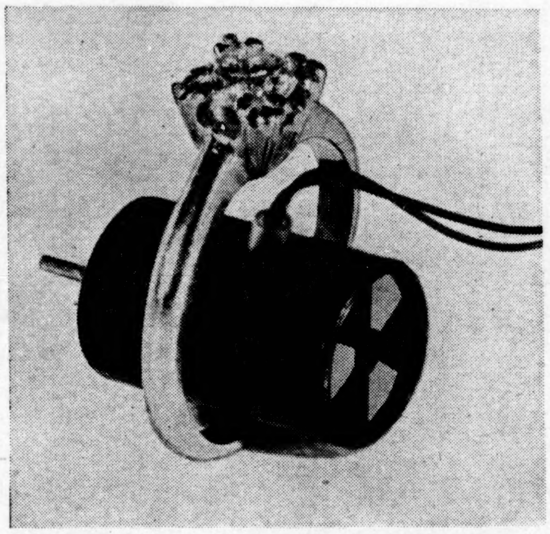
Gold-plated areas are recommended for leadless components so that conductors may be soldered to them. In some cases, a physical indication of polarity may be required but it was urged that it should not be made in a way which might be blurred or destroyed during cleaning or assembly.

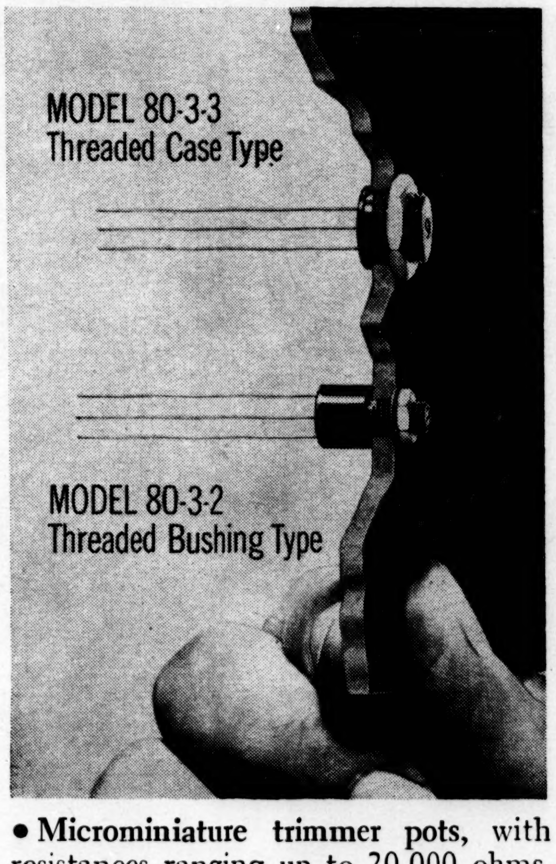
Micro components which, at least in some respects, conform to the formats recommended by the EIA committee are beginning to appear in increasing numbers. Many of these available as regular products or on special order were displayed at the recent Institute of Radio Engineers Show. Among these are components from:

- **Raytheon**—A line of 33 silicon and germanium transistors electrically equivalent to other devices available in TO-5 cases. Germanium units are available in 130-mil diameter x 130-mil high cans while the silicon units are in similar cases, 130 mils x 160 mils in height. Leads extend axially either from the header or in some cases two leads extend from the header, the third through the top of the can.
- **Microwave Associates**—Diffused silicon mesa diodes have a hard glass enclosure fused to the semiconductor junction. Diode is 90 mils in length, 60 mils in depth, has low leakage current and an allowable junction temperature of 200C.
- **Clevite**—A line of glass-sealed "milliminiature" germanium diodes, 50-mils diameter, 160 mils in length, are being made on special order.
- **General Instruments** — Hermetically sealed glass, planar diodes, equivalent to Fairchild's F100. Characteristics of these units include forward conductance of 10 milliamp. at 1 volt, 2 nanoseconds recovery time, and 2 picofarads capacitance.
- **Transitron**—Transitron has a broad line of micro transistors and diodes falling within the formats recommended by EIA committee. This includes npn silicon switching transistors, high conductance diffused silicon diodes, fast switching silicon diodes, voltage regulators and stabistors. Among the more recent additions to its micro component line are micro Zener diodes.
- **Mucon Corp.**—Ceramic capacitors to fit 100-mil modular spacing.
- **California Resistor Corp.**—Wirewound power resistor, $\frac{1}{4}$ in. in length x 0.32 in. in dia., became available before but was not displayed at the IRE Show. Resistor has 1-watt power rating, temperature coefficient less than 0.00002/deg. C.

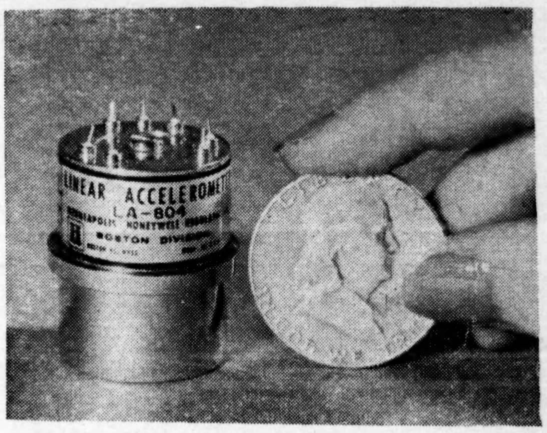
NEW AVIONIC PRODUCTS

- **Microminiature rotary indicator** measures 0.375 in. dia. by 0.56 in. long, for use as malfunction indicator, annunciator or binary read-out. Units can be supplied to operate from any standard d.c. or 400 cps. a.c. voltage. Power consumption is 100 mw. Weight is 3.7 grams. Solenoids which operate indicator are designed for use over temperature range of −65F to 165F. Manufacturer: Daco Instrument Co., Tillary and Prince Streets, Brooklyn 1, N. Y.





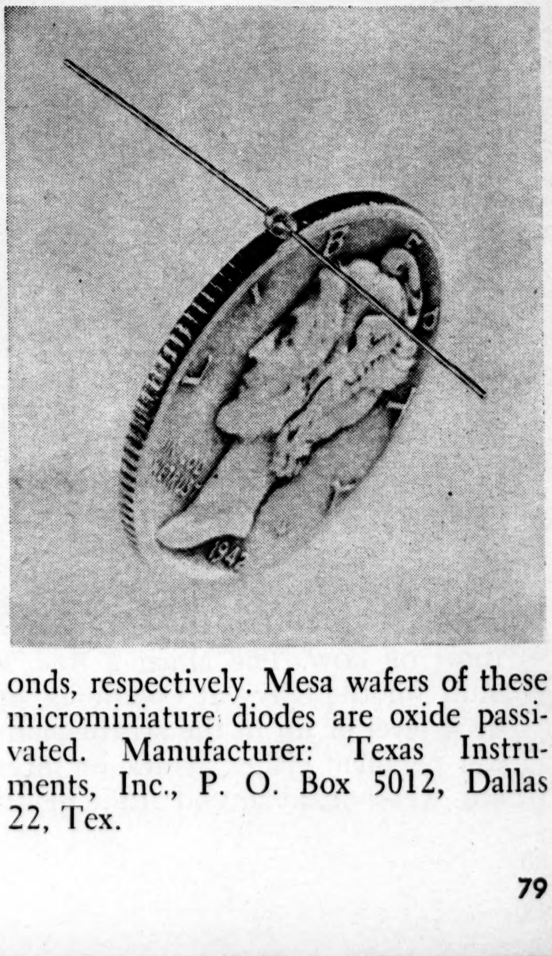
- **Microminiature trimmer pots,** with resistances ranging up to 20,000 ohms, are designed for flush panel mounting. Model 80-3-3 has a $\frac{3}{8}$ in. x 32 threaded case and mounts within the panel with very little projection front or rear. Model 80-3-2 is $\frac{1}{3}$ in. dia and has a 10-32 threaded bushing for panel mounting. Resistance tolerance is 5% and power rating is 1 watt at 50C. Unit withstands 50g shock and vibration of 30g to 2,000 cps., according to manufacturer. Spectrol Electronics Corp., 1704 South Del Mar Ave., San Gabriel, Calif.



- **Subminiature accelerometer,** Type LA-800, non-pendulous with constant damping, measures 1 in. dia. by 1.25 in. long, weighs less than 4 oz. Range of acceleration measurement is 1 to 80g's, with resolution better than 0.0001g's, according to manufacturer. Normal damping ratio is 0.65, ±0.15, over a temperature range of −65F to 250F, but is available with other damping ratios to meet customer requirements. Variable area fluid coupling is used to maintain damping ratio fixed over the wide temperature range. Manufacturer: Minneapolis-Honeywell, 40 Life St., Boston, Mass.

- **Tunnel diode amplifier,** Model OTA 250, capable of covering octave bandwidths in the 250- to 500-mc. range, can realize a noise figure of a 3.5 db. Applications for this device include countermeasures, spectrum analyzers, broadband telemetry, broadband communications and high-definition broadband radar systems. Manufacturer: Micro State Electronics Corp., 152 Floral Ave., Murray Hill, N. J.

- **Silicon mesa diodes,** Types TI-2 and TI-6, hermetically sealed within glass package 60 mils in length and 40 mils diameter, are computer units with recovery times of 10 and 100 nanoseconds, respectively. Mesa wafers of these microminiature diodes are oxide passivated. Manufacturer: Texas Instruments, Inc., P. O. Box 5012, Dallas 22, Tex.



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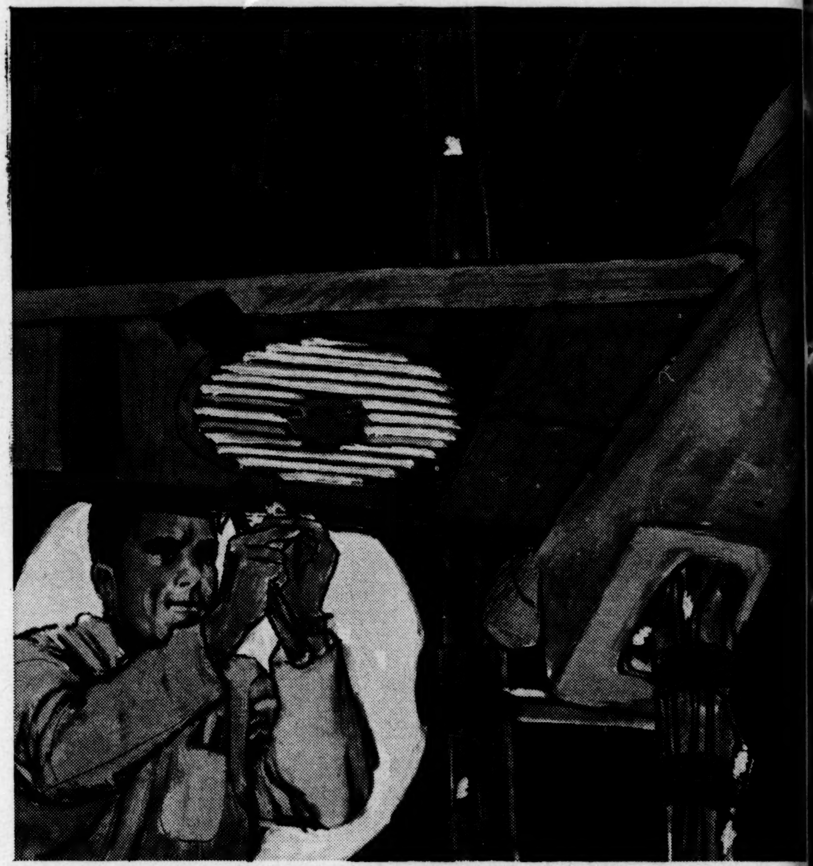
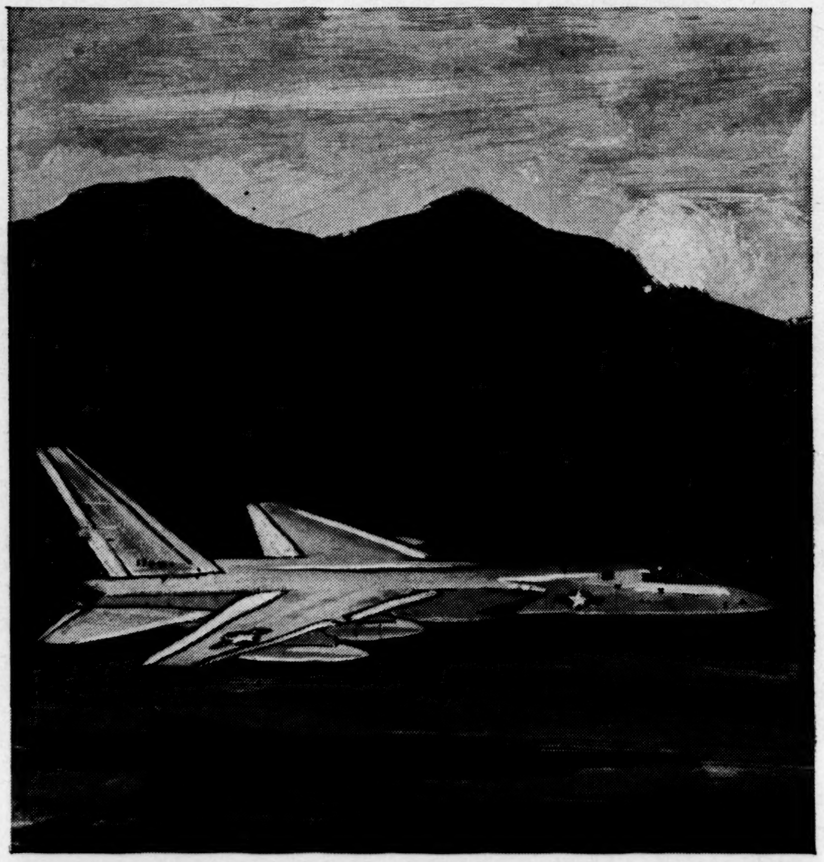
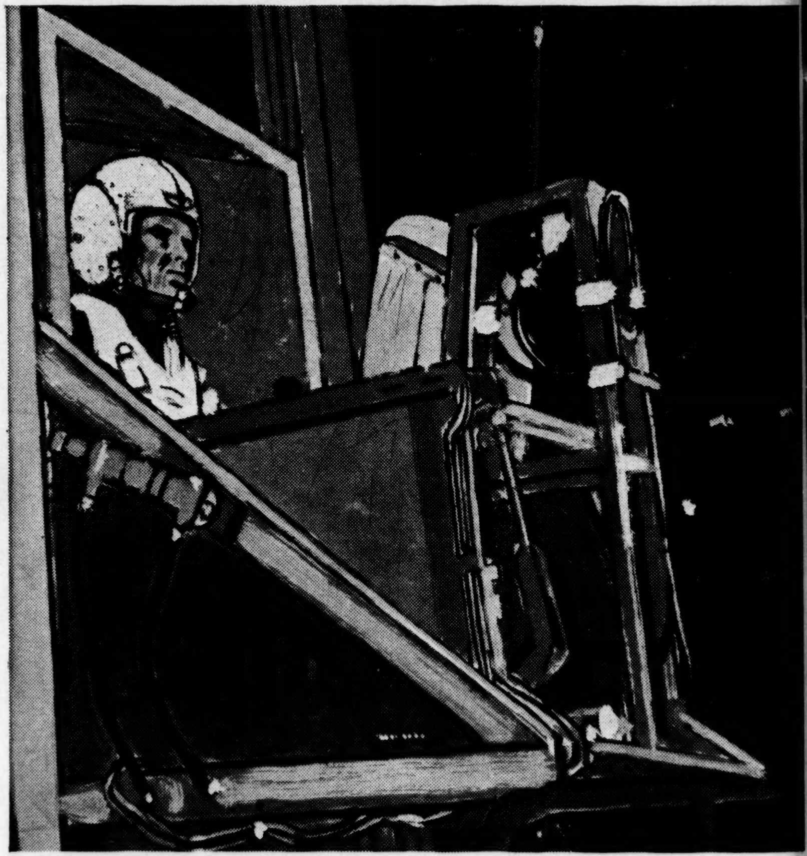


V/STOL FACILITIES. The Free World's largest wind tunnel for the study of transition from vertical to level flight is a part of the facilities at Columbus. Other V/STOL equipment includes six-degree-of-freedom flight simulator, and zero-altitude, zero-speed escape systems.

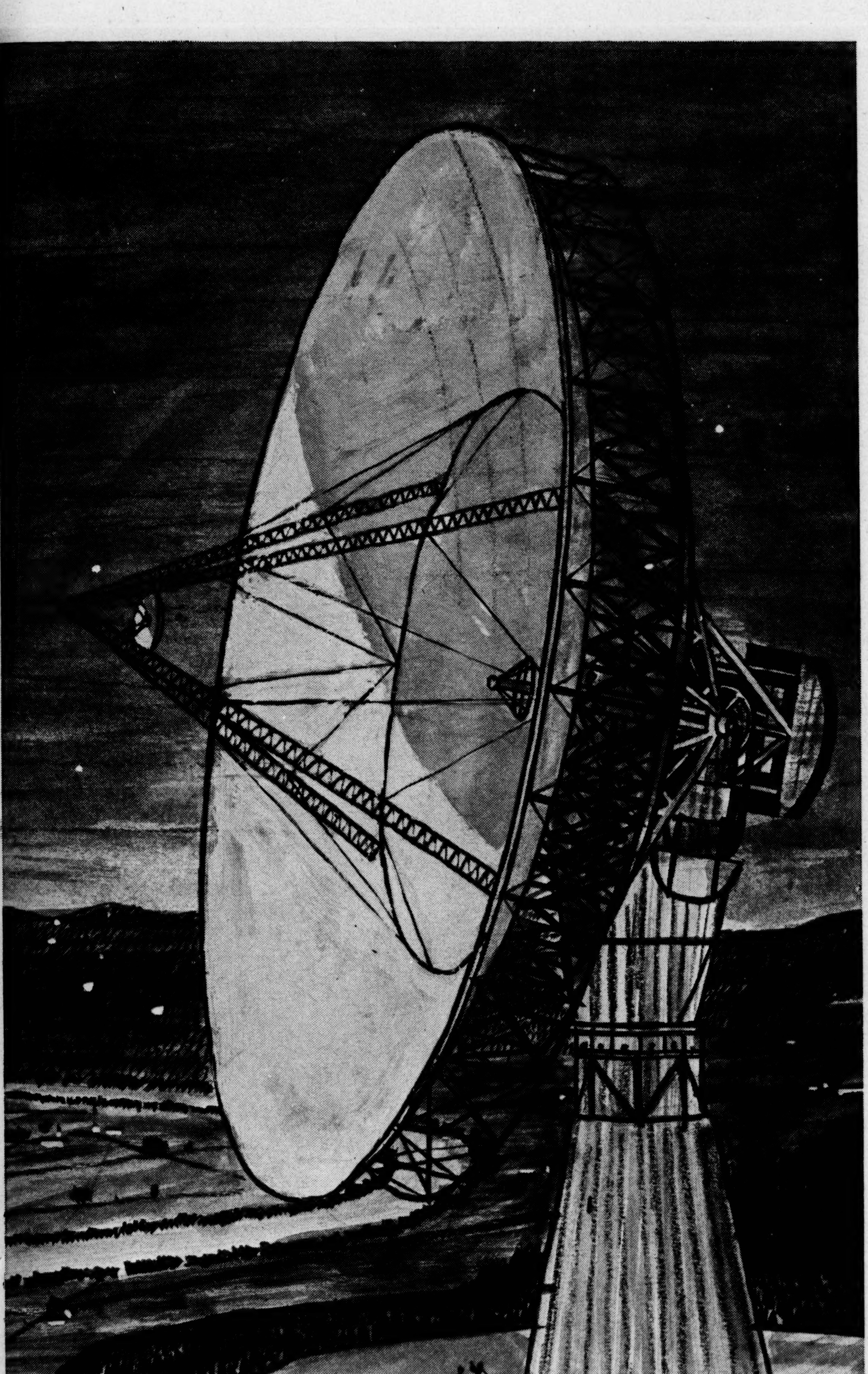


HIGH OR LOW. The Mach 2 A3J Vigilante, now being built for the Navy at Columbus, operates effectively at deck level or up in the stratosphere. The versatile A3J can perform either attack or interception missions in any weather, at any attitude or altitude, day or night.



"G" SEAT. Columbus developed unique "G" seat to study human tolerance to a high degree of vertical acceleration, and to mate human factors to the machine. Advanced low-level high-speed escape systems and pilot response in these flight regimes will be studied with it.

y at NAA-Columbus



RADIO/RADAR ANTENNAS. An advanced type of antenna, constructed to such precise tolerances that it will be tuned to exact pitch, will be built by NAA-Columbus for the Air Force on "Haystack Hill" near Tyngsboro, Mass. Unique design developed at Columbus allows the rigid specifications to be met with significant reductions in dead weight, and in control power requirements.

FILTER CENTER

▶ **New Thermoelectric Materials Revealed**—New group of high-temperature thermoelectric materials, samarium sulfide and cerium sulfide, which can operate at temperatures as high as 2,000F have been developed by Westinghouse Electric under Navy Bureau of Ships sponsorship. Although not yet as efficient as lower-temperature materials, the new rare earth sulfides can be used as toppers in a series of thermoelectric elements, permitting operation at higher temperatures which yield higher over-all generator efficiency.

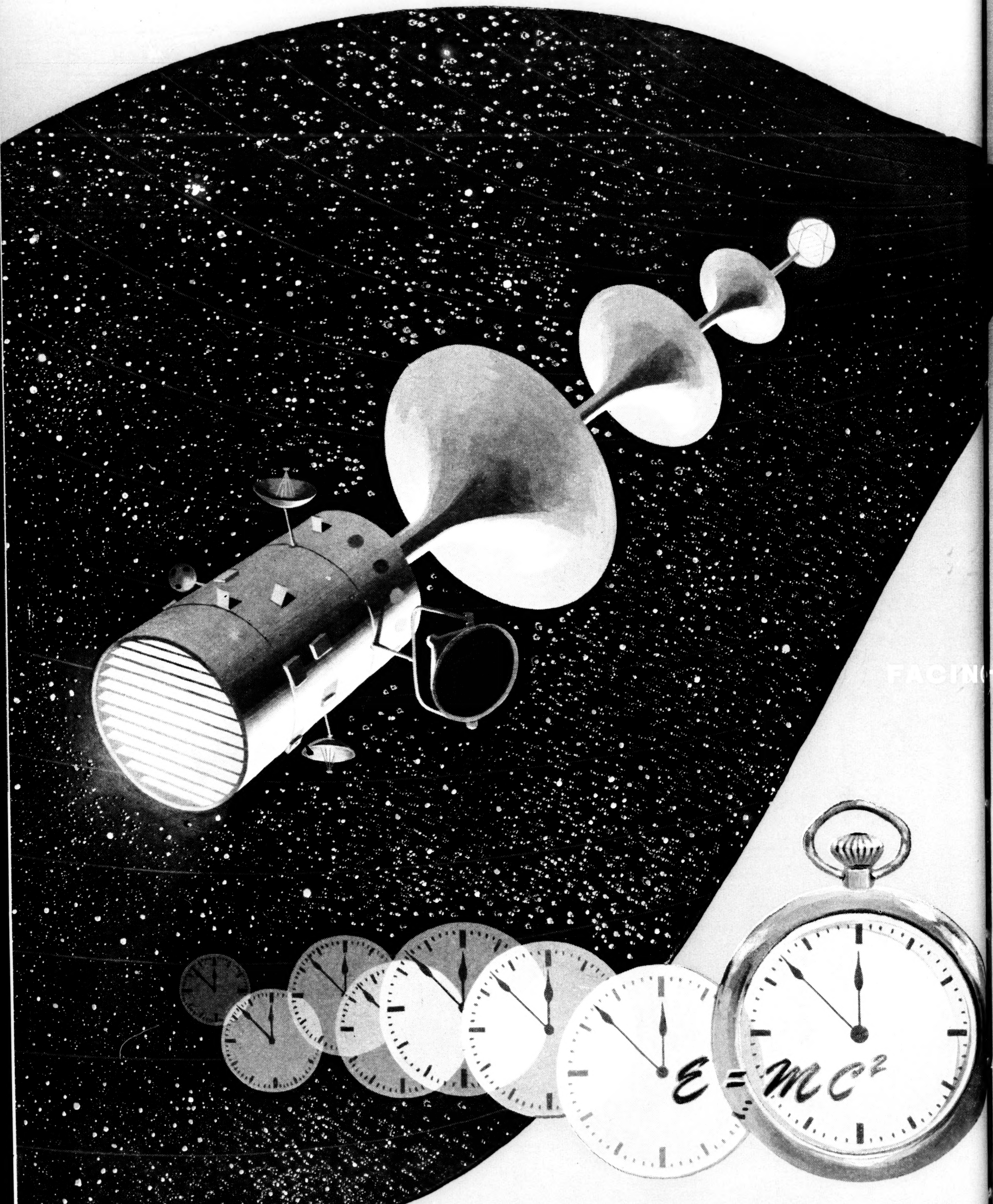
▶ **Automatic Deburring Speeds Gyro Fabrication**—Eclipse-Pioneer Division of Bendix, which builds the inertial guidance system for Pershing ballistic missile, reports that it has automated the deburring of gyro parts, formerly done by hand under a 20-power microscope, cutting time required from eight hours to only six minutes.

▶ **Precision Connector Meeting Scheduled**—A one-day meeting on high precision connectors, which will discuss ways to reduce errors in precision measurements due to connector uncertainties in coaxial equipment at radio and microwave frequencies, will be held June 29 at the Boulder Laboratories of the National Bureau of Standards, Boulder, Colo. Abstracts of papers should be submitted by May 1 to R. C. Powell, NBS Laboratories in Boulder.

▶ **High-Power Static Inverter Developed**—A solid-state inverter, capable of delivering 50 kva., has been constructed by General Electric's General Engineering Laboratory in Schenectady, N. Y. Inverter, which employs silicon controlled rectifiers, operates from 125 v.d.c. and delivers three-phase 120 to 240 v.a.c. power at a frequency which is adjustable between 50 and 500 cps.

▶ **Military Antenna Market Surveyed**—Market survey of military antenna manufacturers by Robert C. Sellers & Associates, indicates that current year's sales will total between $130 million and $240 million. Antenna market in five years is expected to grow to $400-$600 million.

▶ **Long-Range Telemetry Developed**—New long-range telemetry system, called Synchrolink, developed by General Electric's Missile and Space Vehicle Dept., is expected to have a range three times that of any telemetry system yet flown, company says. Synchrolink is a digital telemetry system employing pulse code modulation with phase shift keying (PCM/PS).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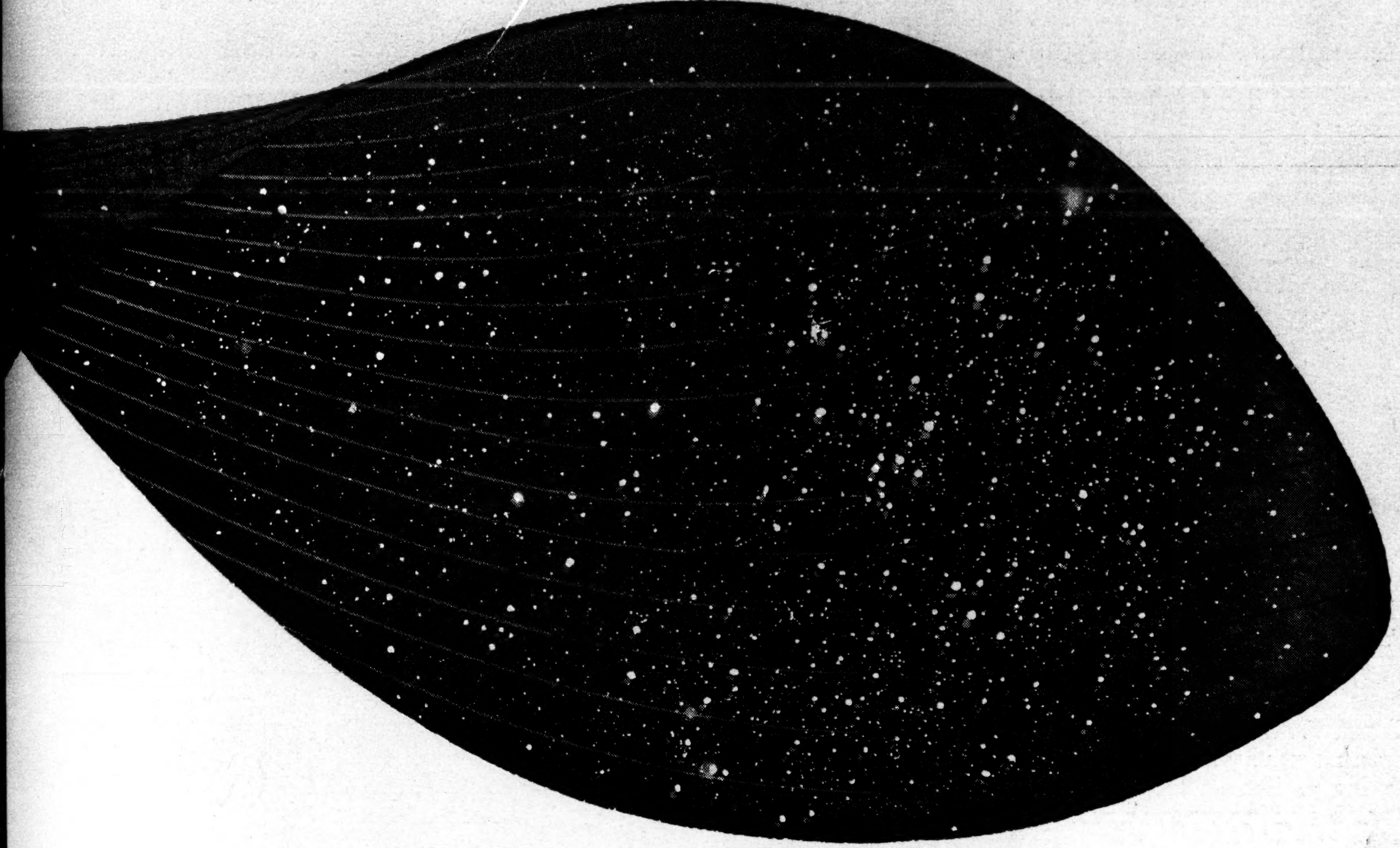

DIMENSION IN PROPULSION

Whether the universe has a "saddle shape," or any shape at all, is a matter of interesting conjecture. The matter of space travel, however, is the subject of intense experimentation. A nuclear/thermionic/ionic propulsion system, currently being studied at Lockheed Missiles and Space Division, might well become the power source for space vehicles.

Its design incorporates a nuclear reactor only one foot in diameter, generating heat at a temperature of 1850°K. This is transmitted to banks of thermionic generators, converting the heat directly into electrical energy for the ion beam motor which uses cesium vapor as a fuel. The entire system is designed without any moving parts, minimizing the possibility of failure.

Lockheed's investigation of propulsion covers a number of potential systems. They include: plasma, ionic, nuclear, unique concepts in chemical systems involving high-energy solid and liquid propellents, combined solid-liquid chemical systems. The fundamentals of magnetohydrodynamics, as they might eventually apply to propulsion systems, are also being examined. Just as thoroughly, Lockheed probes all missile and space disciplines in depth. The extensive facilities of the research and development laboratories—together with the opportunity of working with men who are acknowledged leaders in their fields—make association with Lockheed truly rewarding and satisfying.

Lockheed Missiles and Space Division in Sunnyvale and Palo Alto, on the beautiful San Francisco Peninsula, is an exciting and challenging place to work. For further information, write Research and Development Staff, Department M-24D, 962 West El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required.

Lockheed / **MISSILES AND SPACE DIVISION**

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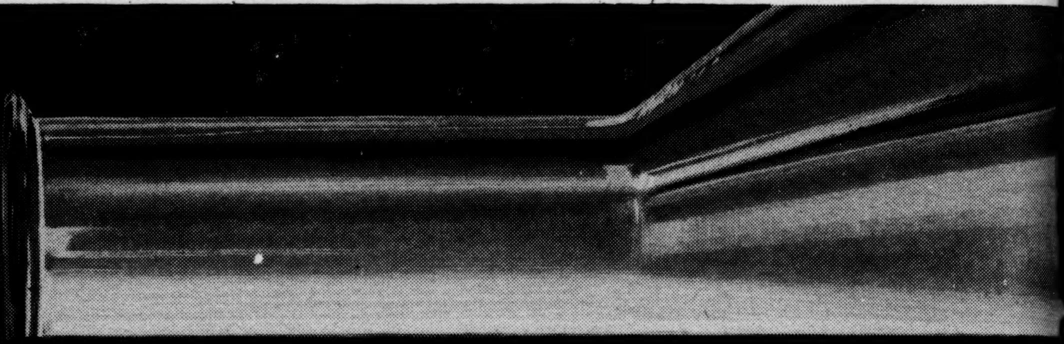

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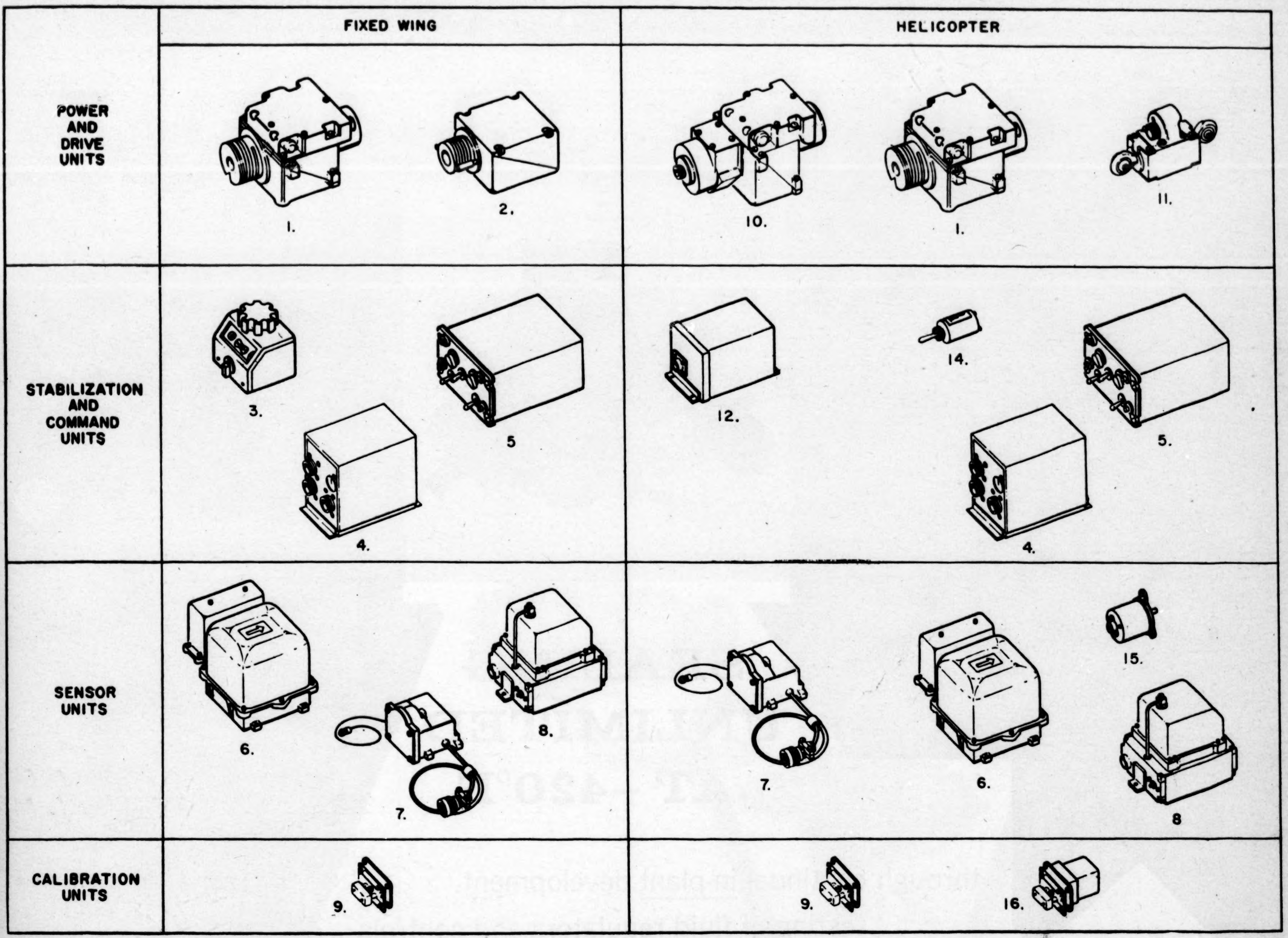


BASIC UNITS of universal automatic flight control system are roll, pitch and yaw power units (1), trim power unit (2), flight controller (3), attitude reference control (4), navigational coupler (5), vertical gyro (6), accelerometer (7), altitude control (8), calibration card (9), pitch and roll power unit for helicopter (10), linear actuator (11), collective pitch command control (12), rpm. switch (14), command pickoff (15) and rpm. sensor (16).

V/STOL Control System Design Unveiled

Phoenix, Ariz.—Details of a universal automatic flight control system which will provide stabilization and control functions for the Army's manned fixed-wing and rotary-wing aircraft and for pilotless drones were disclosed here by the Sperry Phoenix Co.

The system, designated AN/ASW-12(V), can maintain an aircraft's position to within ¼ deg. of a desired attitude, sufficient for Army aircraft reconnaissance or side-looking-radar missions. System, developed under contract to Army Signal Research and Development Laboratories, is intended to be usable with only minor changes on a wide variety of Army aircraft, including future high-performance V/STOL aircraft.

Universal systems of this type were installed and flight tested in a series of military aircraft including the Vertol H-21 and Sikorsky H-37 helicopters and the Beech L-23D. Production versions are now going into the Grumman AO-1 Mohawk; others are slated for the de Havilland DHC-4 Caribou and possibly the Vertol YHC-1B Chinook helicopter. Three-axis stabilization is provided for fixed-wing aircraft; up to five-axis (roll, pitch, yaw, altitude and rotor speed control) is provided for helicopters.

System Flexibility

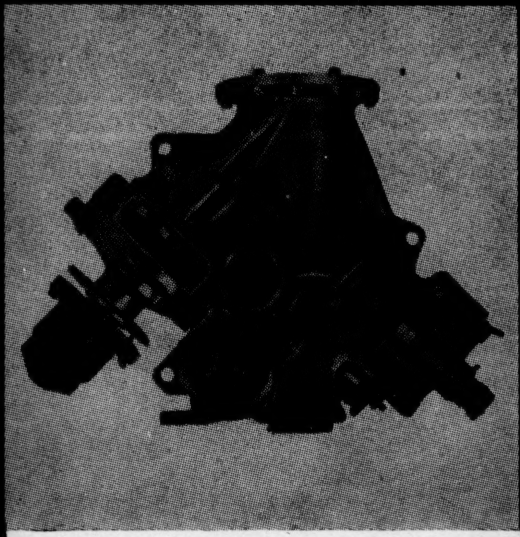
Flexibility in the system comes about through the use of a common series of component units, or modules, interchangeable from aircraft to aircraft. The modules are so designed that they can be installed with only minor adjustments as a system into a variety of aircraft types. For use in helicopters, basically the same components, supplemented by several additional units, can be integrated into a rotary-wing flight control system.

This universal characteristic—a maximum number of interchangeable modules suitable for use in many aircraft types—is the source of important advantages for military aircraft. It eases maintenance, cuts down on technician training time, simplifies logistics and lessens necessary cabling and harnessing. A fixed-wing, three-axis system with navigational coupling weighs 40 lb., while a 5-axis helicopter system weighs 54 lb.

Functions which can be provided by the system are:

- **Attitude stabilization** (pitch and roll).
- **Heading stabilization,** including a heading select function.
- **Altitude stabilization** with control provided by barometric, radar or glide path inputs.
- **Path guidance** with commands accepted through a coupling device from automatic navigational equipment such as doppler radar, ILS or VOR.
- **Engine rpm. control** (for helicopters only).

In designing the system, Sperry engineers abandoned the classic autopilot concept with its multitude of inputs and outputs and attempted to make each module of the system functionally independent. Hence, the idea of



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Openings exist for qualified engineers.

SWINGING below Army H-21 helicopter is a 600-lb. load serving as a pendulum during tests of Army-Sperry Phoenix universal flight control system in the desert near Sperry plant in Phoenix.

grouping all tubes or transistors required for control of the aircraft's three flight axes into a single package for convenience of shock mounting—largely a carryover from pre-transistor days—was discarded. The older approach meant that servo amplifier and motor for a given axis were packaged separately, Larry Kaufman, engineering project chief on the universal control system, points out.

Instead, in the Army-Sperry approach, the entire servo system for each axis is grouped as a single self-contained low-power package. This unit is common for each axis and for all aircraft, and one such unit differs from another by a small external plug-in calibration unit (containing resistance-capacitance networks) for obtaining attitude error and rate of attitude error signals. This approach, Kaufman says, also simplifies production in that amplifier and servo can be mated and tested together.

Components of the system are grouped by their functions into four general types—power and drive units, stabilization and command units, sensor units and calibration units. The nature and the number of units required, and where they might be located in a typical fixed-wing system, are shown in an accompanying drawing of an L-23. In the fixed-wing installation, power and drive units accept electrical commands from stabilization and command units, then mechanically position the aircraft's control surfaces. In a helicopter, power and drive and a sensor (command pickoff) are mechanically connected to helicopter attitude, collective pitch and engine throttle controls. Stabilization, command and remaining sensor units are tied to power and drive units.

The relationship of components for

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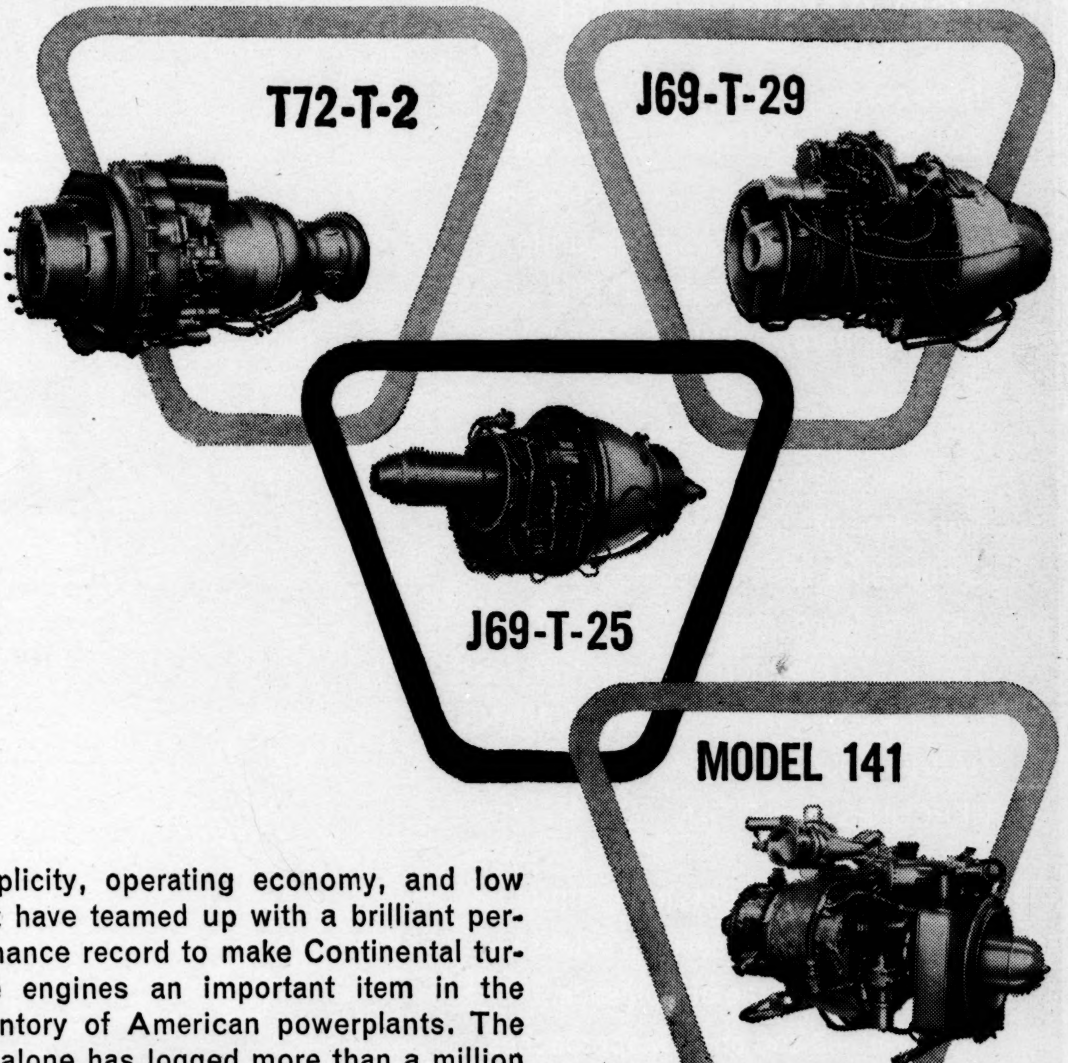

Simplicity, operating economy, and low cost have teamed up with a brilliant performance record to make Continental turbine engines an important item in the inventory of American powerplants. The J69 alone has logged more than a million operating hours to date. Advanced models growing out of the J69 program now await industry application. They include aircraft turbojets of 1,400 and 2,400 lbs. thrust, "aft-fan" turbofan engines of 2,600 and 4,000 lbs. thrust, a target-missile turbojet of 2,550 lbs. thrust, altitude thrust augmentation devices for existing turbojets, and the J69-T-35 air pump for boundary layer control. Rounding out Continental's capability in the field of aircraft propulsion is a completely new series of turboshaft and turboprop engines, including the 500-hp, 6,000-rpm 217-5A (U. S. Navy designation T72-T-2) turboshaft, which promises to find use in a wide variety of applications.

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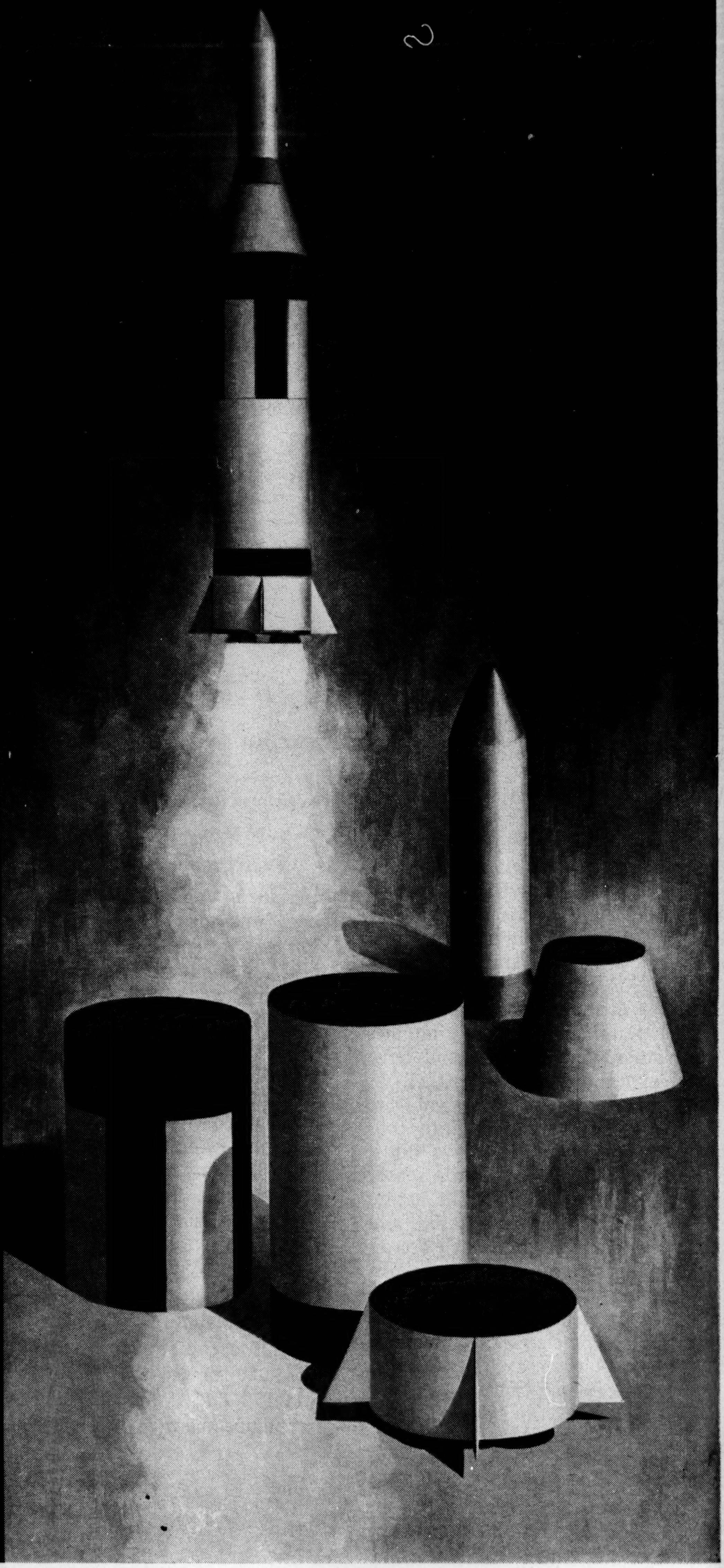

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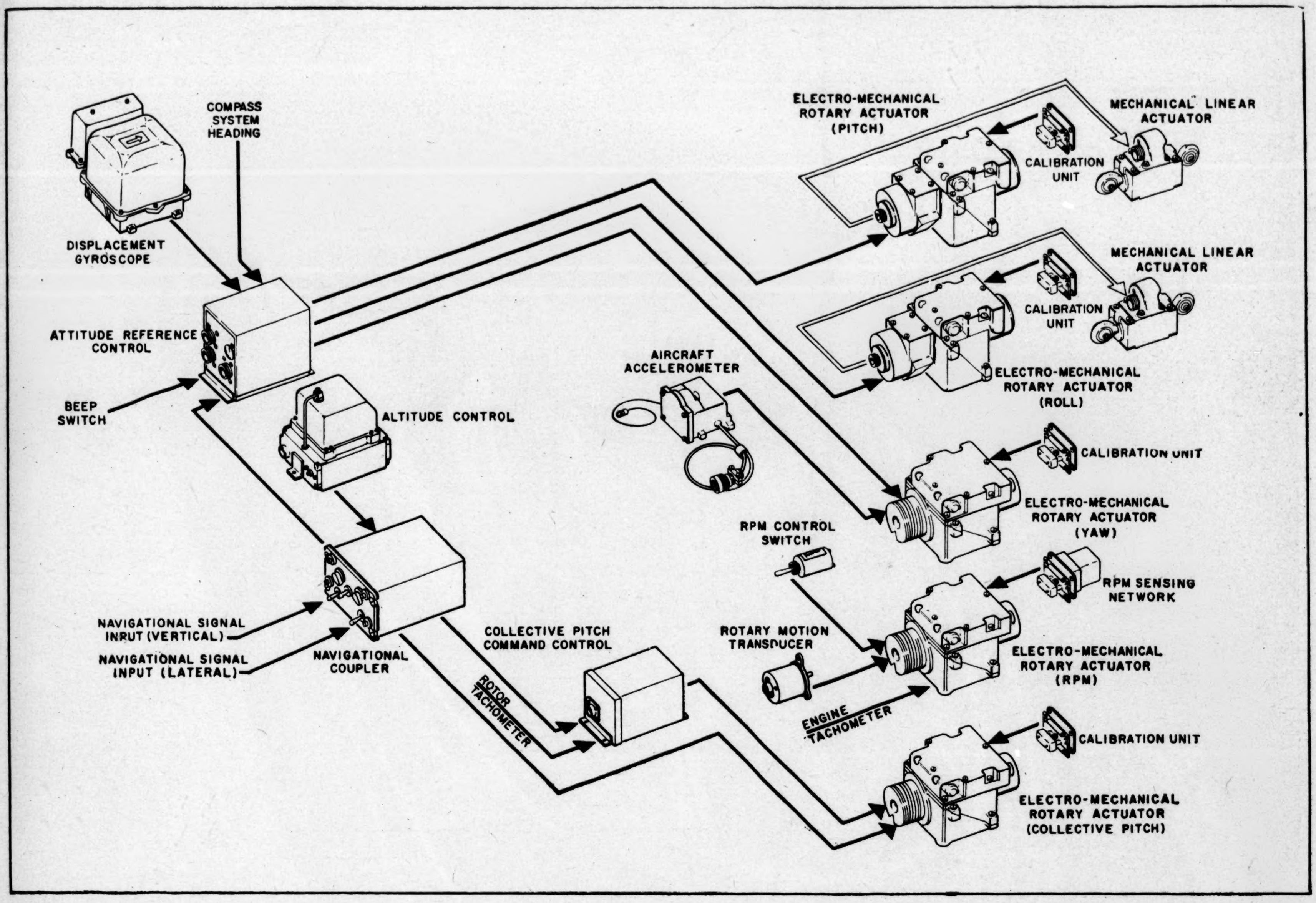
Engineers, scientists—investigate outstanding opportunities at Aerojet

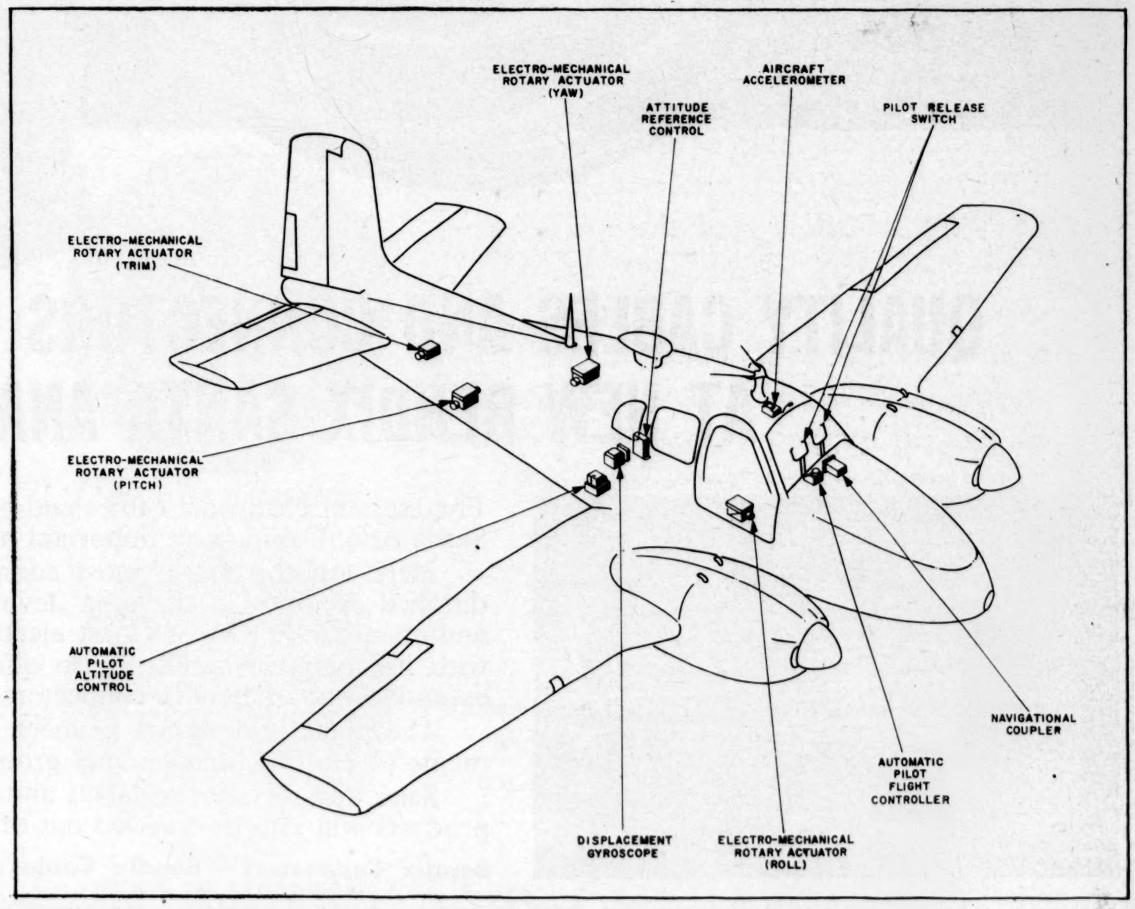

COMPASS SYSTEM HEADING
DISPLACEMENT GYROSCOPE
ATTITUDE REFERENCE CONTROL
BEEP SWITCH
ALTITUDE CONTROL
NAVIGATIONAL SIGNAL INPUT (VERTICAL)
NAVIGATIONAL SIGNAL INPUT (LATERAL)
NAVIGATIONAL COUPLER
COLLECTIVE PITCH COMMAND CONTROL
ROTOR TACHOMETER
AIRCRAFT ACCELEROMETER
RPM CONTROL SWITCH
ROTARY MOTION TRANSDUCER
ENGINE TACHOMETER
ELECTRO-MECHANICAL ROTARY ACTUATOR (PITCH)
MECHANICAL LINEAR ACTUATOR
CALIBRATION UNIT
MECHANICAL LINEAR ACTUATOR
CALIBRATION UNIT
ELECTRO-MECHANICAL ROTARY ACTUATOR (ROLL)
CALIBRATION UNIT
ELECTRO-MECHANICAL ROTARY ACTUATOR (YAW)
RPM SENSING NETWORK
ELECTRO-MECHANICAL ROTARY ACTUATOR (RPM)
CALIBRATION UNIT
ELECTRO-MECHANICAL ROTARY ACTUATOR (COLLECTIVE PITCH)

BASIC COMPONENTS of helicopter version of Army-Sperry Phoenix Co. universal flight control system. Heavy black lines indicate electrical relationship; other is flexible shaft. System, able to provide pitch, roll, yaw, collective pitch and rotor rpm, control, weighs 54 lb.

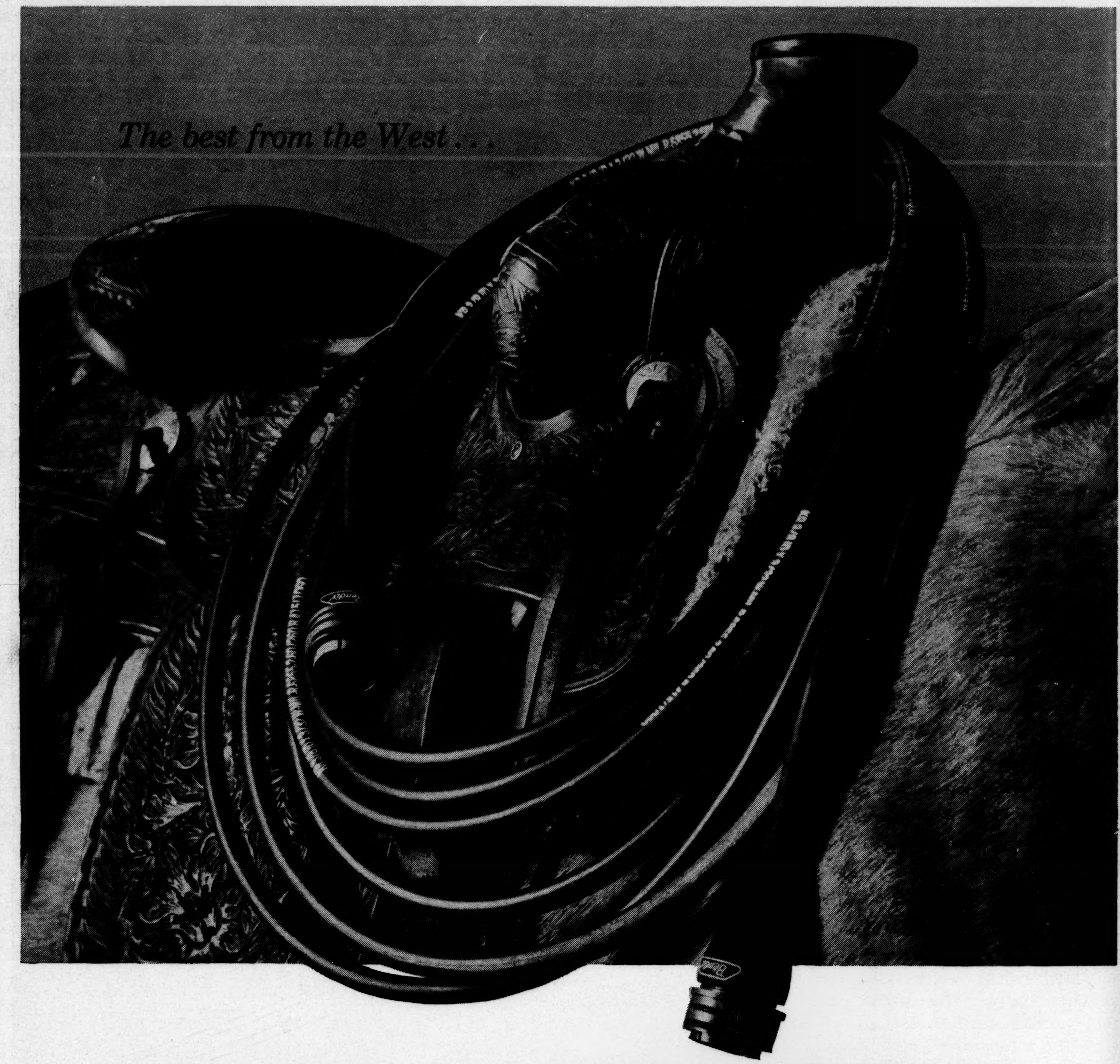
the fixed-wing system is shown in an accompanying signal flow diagram. Signal flow divides into pitch, roll and yaw control channels. The system is activated when electrically operated clutches connect the power units to the aircraft control system. Signals from the sensor units, stabilization and command units and navigation aids provide attitude and heading stabilization, altitude control and/or automatic path guidance depending upon selected operating mode. Although control channels are electrically independent, operation of the roll control channel for command of banked turns is coordinated with the yaw control channel for turn coordination.

Operation of a typical control channel, the pitch channel, for the fixed-wing system is as follows: Pitch attitude of the aircraft is controlled by the pitch power unit's positioning of the elevator control. The pitch power unit accepts signals from these sources:

- **Vertical gyro,** which measures the aircraft's pitch attitude.
- **Cockpit-mounted flight controller**—Signals from controller are initiated by attitude change commanded by pilot.
- **Altitude control** measures change in barometric altitude.
- **Radar altimeter** measures change in


ELECTRO-MECHANICAL ROTARY ACTUATOR (YAW)
AIRCRAFT ACCELEROMETER
ATTITUDE REFERENCE CONTROL
PILOT RELEASE SWITCH
ELECTRO-MECHANICAL ROTARY ACTUATOR (TRIM)
ELECTRO-MECHANICAL ROTARY ACTUATOR (PITCH)
AUTOMATIC PILOT ALTITUDE CONTROL
NAVIGATIONAL COUPLER
AUTOMATIC PILOT FLIGHT CONTROLLER
DISPLACEMENT GYROSCOPE
ELECTRO-MECHANICAL ROTARY ACTUATOR (ROLL)

TYPICAL LAYOUT of basic components or modules, of Army-Sperry Phoenix universal flight control system is shown in this drawing of a Beech L-23. System has been successfully tested in several Army aircraft and is being produced in quantity for installation in at least several Army fixed-wing aircraft and helicopters. Modules are interchangeable from aircraft to aircraft with only minor adjustments to form basic three-axis flight control for fixed-wing; five-axis control for rotary-wing.



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For users of electronic cables and connectors, Scintilla Division's new plant in Santa Ana, Calif., is an important addition to West Coast industry.

Here are the finest, most complete, environmentally-controlled, air-conditioned facilities in the area devoted exclusively to cable development and manufacture. For West Coast electrical connector users the Santa Ana plant with its complete facilities also offers "short-order" assembly service on the extensive line of Bendix connectors.

The plant is designed to meet the standard and special-purpose requirements of aircraft, missiles and ground-based electronic equipment.

Sales and service for cables and connectors and all other Scintilla Division products will still be handled out of 117 E. Providencia Ave., Burbank, Calif.

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radar altitude from a selected altitude.

- **Glide path signal** measures deviation in altitude between the aircraft's path and the approach glide path.

Vertical gyro and flight controller signals maintain the aircraft at the desired pitch attitude. Both signals are fed to the pitch control channel of the altitude reference control. The vertical gyro signal is compared with a reference, while the flight controller signal changes reference attitude at a fixed rate, in a nose-down or nose-up direction, as the pilot advances or retracts a knob on the controller. Differences between reference attitude chosen by the pilot and actual pitch attitude sensed by the vertical gyro are then fed to the pitch power unit which positions the elevator to null the difference.

Desired altitudes can be maintained by signals from several sources. The pilot operating a vertical select switch on the control panel of the navigational coupler through which all altitude signals pass to the pitch control channel selects the source of altitude control commands—radar altimeter, glide path receiver or barometric pressure reference. If he selected the barometric altitude control function, for example, signals would be fed from the altitude control through the navigational coupler to the pitch control channel. These would command changes in pitch attitude necessary to hold constant barometric altitude. Similarly, glide path and radar altimeter signals can control approach or radar altitude.

Power Units

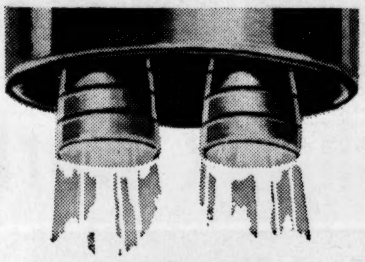
Principal units of the flight control system include:

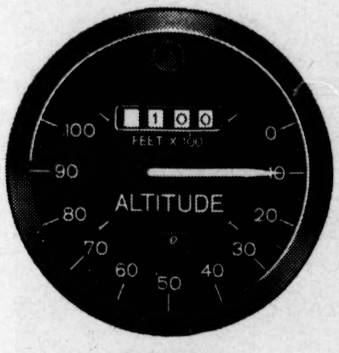
- **Power units**—Power units (one required for each axis of both fixed-wing aircraft and helicopters) are identical except for gear ratios and power train ratios. Each is a 5½-lb. package, designated electro-mechanical rotary actuators by the Army. They are regarded by Sperry as the heart of the system.

Each power unit consists of a transistorized amplifier, servodrive and drum and bracket assembly. They are capable of receiving direct commands from the pilot or automatic navigation equipment and computing action required to fulfill each command.

The package is designed so that the servomotor and the remainder of the drive assembly, as well as the avionics assembly, can be pulled out by removing captive screws in the case. This is done without disturbing the control rigging of the aircraft and leaves only a drum bearing and gear attached to the rigging. Operationally, the unit converts electrical error signals into rotary motion of its cable drum to move control surfaces of the aircraft.

- **Trim power unit**—Trim power output is applied through rotary motion of an





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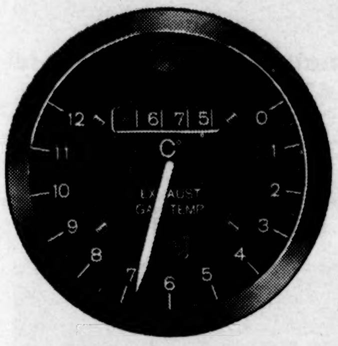

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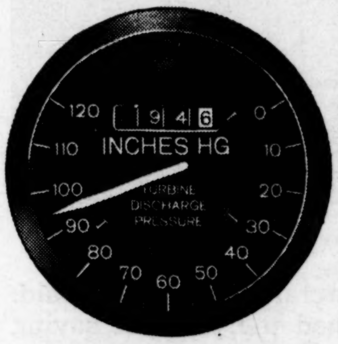

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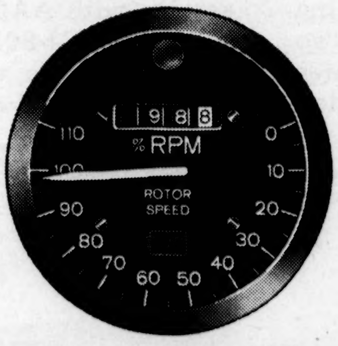

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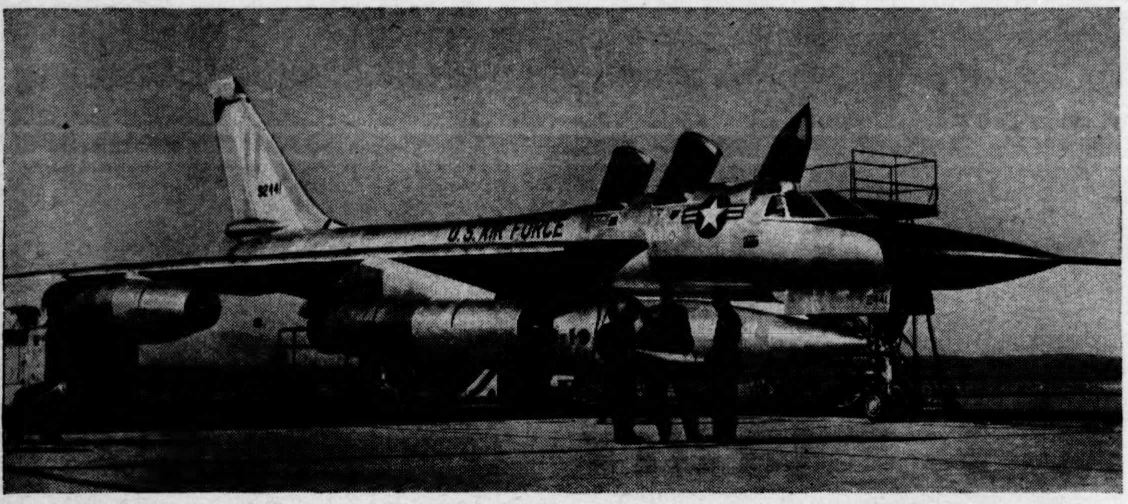
Flight Propulsion

Convair Hustlers Smash Six World Speed Records



One of SAC's record-breaking B-58 flight crews checks final flight plan prior to takeoff. This J79-powered Hustler logged a top speed of 1430 mph during its run.

Log Top Speed of 1430 mph

EDWARDS AFB, Cal.—Six world speed records, five of them Russian-held, were nearly doubled here recently by two Convair B-58 Hustlers from SAC's 43rd Bomb Wing.

The Hustlers were powered by General Electric J79 turbojet engines, which have now helped set 18 world speed, altitude and payload records in little more than a year.

A B-58 piloted by Maj. H. J. Deutschendorf averaged 1061.8 mph while carrying a 2000 kg (kilogram) payload over a 2000 kilometer closed course. The record claim, which is over 450 mph faster than that previously held by a Russian Tu-104, was also entered for the no-payload and 1000 kg payload categories.

Two days later another B-58 swept over a 1000 km course at an average speed of 1248.7 mph. Records were claimed for the same three payloads. The Hustler, piloted by Maj. H. E. Confer, logged a top speed of 1430 mph during the run.

The previous 1000 km record was held by an Air Force F-101 Voodoo in the no-payload class, with 700.5 mph, and by Russia, (639 mph), in the 1000 and 2000 kg categories.

B-58 AWARDED THOMPSON TROPHY...

WASHINGTON, D.C.—The Convair B-58 piloted by Maj. H. E. Confer was awarded the coveted Thompson Trophy in late February for its record-breaking closed course speed of 1430 mph.

It is the first time in aviation history that the trophy has been won by a heavy bomber. The award is presented annually by the Air Foundation of Cleveland.

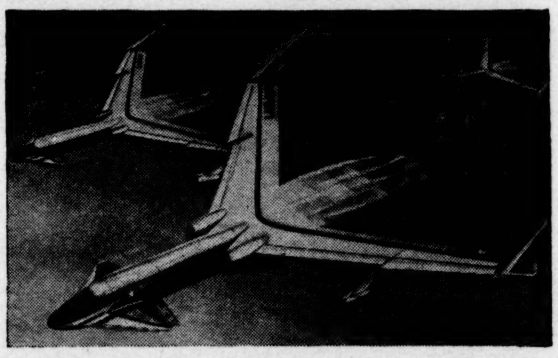
Nuclear Flight by '65 Is G-E Program Goal

CINCINNATI, Ohio—Nuclear-powered flight by 1965—or even sooner—is both possible and practical, according to David F. Shaw, general manager of General Electric's Aircraft Nuclear Propulsion Department.

"Since January, 1956, we have successfully operated modified J47 turbojets for hundreds of hours on nuclear power," Mr. Shaw said. "We have also successfully completed experimental tests on advanced reactors, and are now designing a high-performance nuclear-powered turbojet for flight testing in the mid-1960's.

"Full-scale turbojets specifically designed for nuclear power have also been operated hundreds of hours in test cells on chemical fuels. They have met or exceeded all performance estimates.

"It is no longer a question of can we build a nuclear-powered aircraft engine, but when we can place such an engine in an aircraft," Mr. Shaw said. "We have reached the point of saying that when an airframe is ready, we can have the direct-air-cycle nuclear turbojet ready for installation.



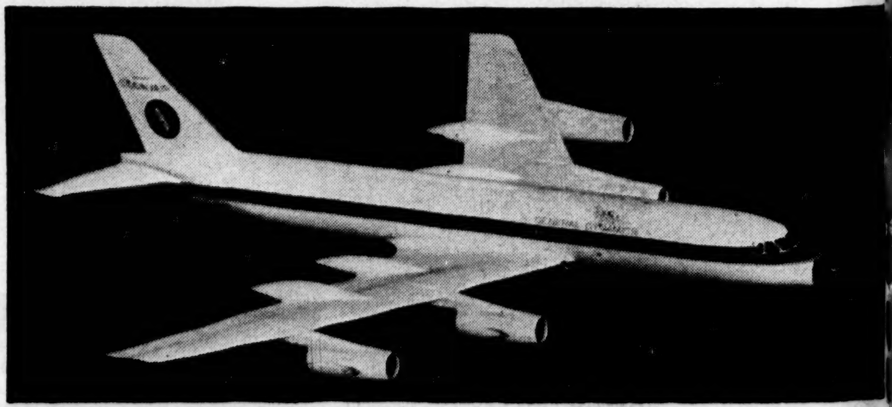
Proposed Convair Nuclear Airplane

Use the coupon (check GEA-7105) if you would like further information on G.E.'s aircraft nuclear engine program.

The CJ-805 Aloft: 880 Nears First Anniversary; 990 and

CONVAIR 880—Fastest jetliner now in commercial service, the Convair 880 will enter its second year of operation on May 15. The CJ-805-3 powered transport is now flying with Delta, Northeast, and Trans World Airlines, and will "go international" in mid-year when Japan Air Lines inaugurates 880 jet service linking Tokyo with other major Far East cities.

CONVAIR 990—The 640-mph jet flew for the first time on January 24 and is being flight tested prior to scheduled service with AAL, REAL, Swissair, and SAS later this year. Four G-E CJ-805-23 aft-fan engines power the 990, whose maiden voyage was described by Convair Chief Test Pilot Don Germeraad as, "The cleanest I've had in six first flights."



NEWS

A report about progress in research and products from the Flight Propulsion Division of the General Electric Company

SAC Hustlers Complete Six Months of Operation

CARSWELL AFB, Tex.—SAC's 43rd Bomb Wing—the Air Force's first operational group of Convair B-58 Hustlers—has completed its first six months of operational duty here.

During more than 4000 hours of engine flight time, reliability of the Hustlers' J79-5B turbojets was evidenced by a rate of approximately 400 hours between unscheduled engine removals for all causes.

Engine flight time for all phases of the Air Force's and Convair's B-58 program is currently over 25,000 hours. Four General Electric J79's power the Mach 2 bomber with a combined thrust of over 62,000 pounds.

First Year of Flight Testing Confirms Aft-fan Principle

CINCINNATI, Ohio—"General Electric's first year of turbo-fan flight testing has proven beyond a doubt the soundness and practicability of the aft-fan principle," according to G-E Commercial Engine Operation Manager Neil Burgess.

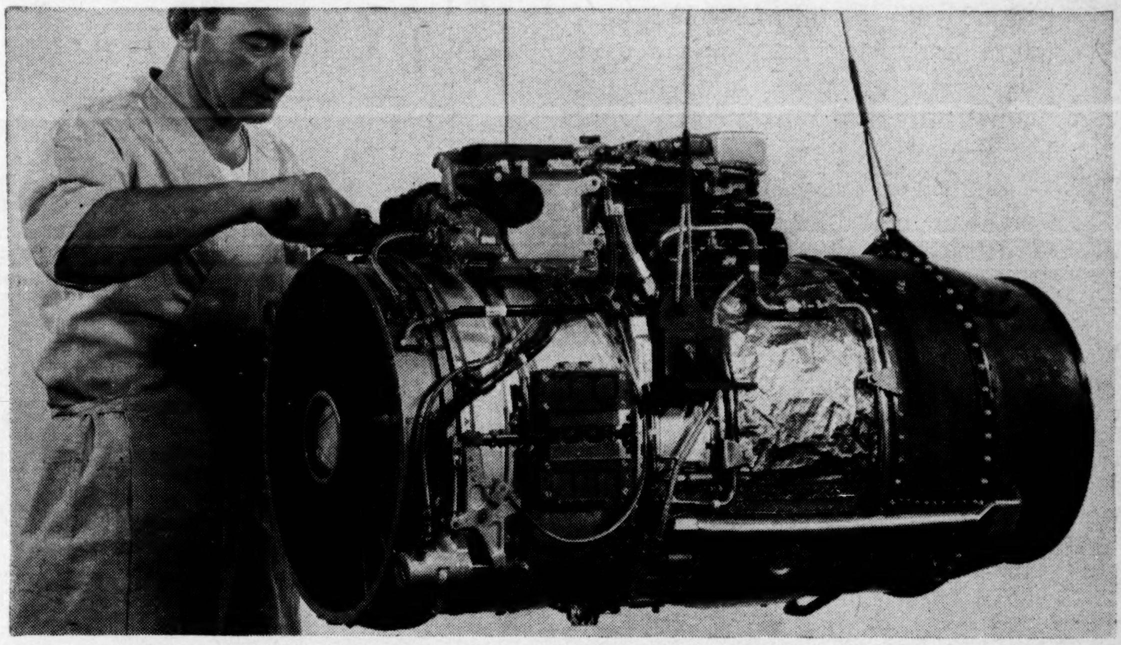
His comment was occasioned on the first anniversary of American turbo-fan flight last February 19. On that day a year ago a G.E.-leased RB-66 flew aloft powered by two CJ-805-23s.

"The engines," reported Mr. Burgess, "have been operated over a complete range of altitudes and air speeds, under severe distorted inlet conditions, and with two entirely new nacelle designs. The fan has in no way compromised the good throttle response characteristics of the engine.

"In all cases," he said, "we have been completely satisfied with the engine operating characteristics. In particular, the low noise levels of the engine are outstanding."

During this period, two other aircraft—the Convair 990 and G.E.'s Caravelle VII—also initiated flight test programs using G-E aft-fan engines.

A growth version of the commercial aft-fan engine, the MF239C-3, is being offered for the MATS SS467 cargo transport. It will develop up to 23,800 pounds of takeoff thrust, as compared with 16,100 for the CJ-805-23.



G.E.'s modified 10-to-1-ratio J85 will be ideal for VTOL, STOL, and copter boost power.

J85 Modified to Produce 10 to 1 Power Ratio

LYNN, Mass.—General Electric's J85 turbojet engine can now be modified to produce a thrust-to-weight ratio of more than 10 to 1.

Production J85 engines currently entering service with the Air Force deliver a specified 7.6 to 1 ratio, the highest of any military production jet powerplant.

The 10 to 1 power ratio makes the modified J85 an ideal engine to provide auxiliary power for VTOL and STOL aircraft. Here its primary use would be to provide boost power for takeoff and landing operations.

Adaptation of the modified engine to helicopters, where it could substantially augment cruise power and lift power, is also a possibility.

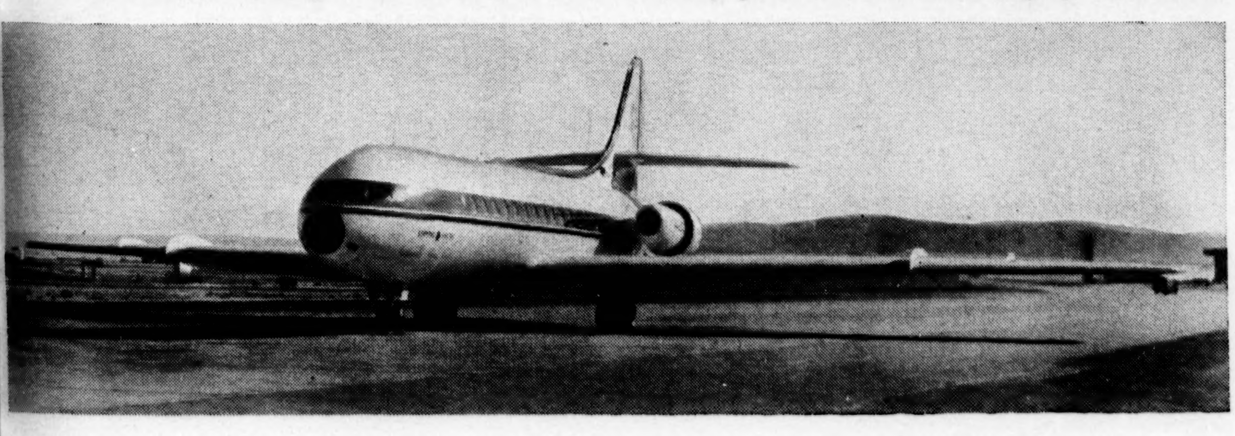
Boosting the J85's power ratio to 10 to 1 was accomplished by removing accessories—reducing engine weight from 325 pounds to less than 300—and by increasing engine speed and temperature. Over-all dimensions are similar to those of the J85-7.

A dry commercial version of the J85—the CJ610—develops 2850 pounds of thrust, weighs only 355 pounds.

Use the coupon (check GED-4095) if you would like further information on the G-E J85 turbojet engine.

Caravelle Flight Tests Progress Well

SUD/DOUGLAS CARAVELLE VII—Now entering its fourth month of intensive flight testing after conversion to General Electric CJ-805-23 aft-fan turbojet engines, G.E.'s Caravelle VII is currently in the midst of a heavily instrumented flight program marked for completion this spring. Tests have included in-flight noise measurements, duct inlet design confirmations, and thrust reverser trials. Performance to date, including noise level and short-runway prowess, has been highly favorable.



FOR MORE INFORMATION

If you would like free brochures on these or other G-E flight propulsion products, just clip and send this coupon.

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output drum to the fixed-wing aircraft's elevator trim tabs. The single unit required consists of servodrive and drum and bracket assemblies and derives its input from the output of the pitch servo amplifier in the pitch power unit. Unlike the other power units, it does not contain its own separate servo amplifier. It weighs 2.5 lb.

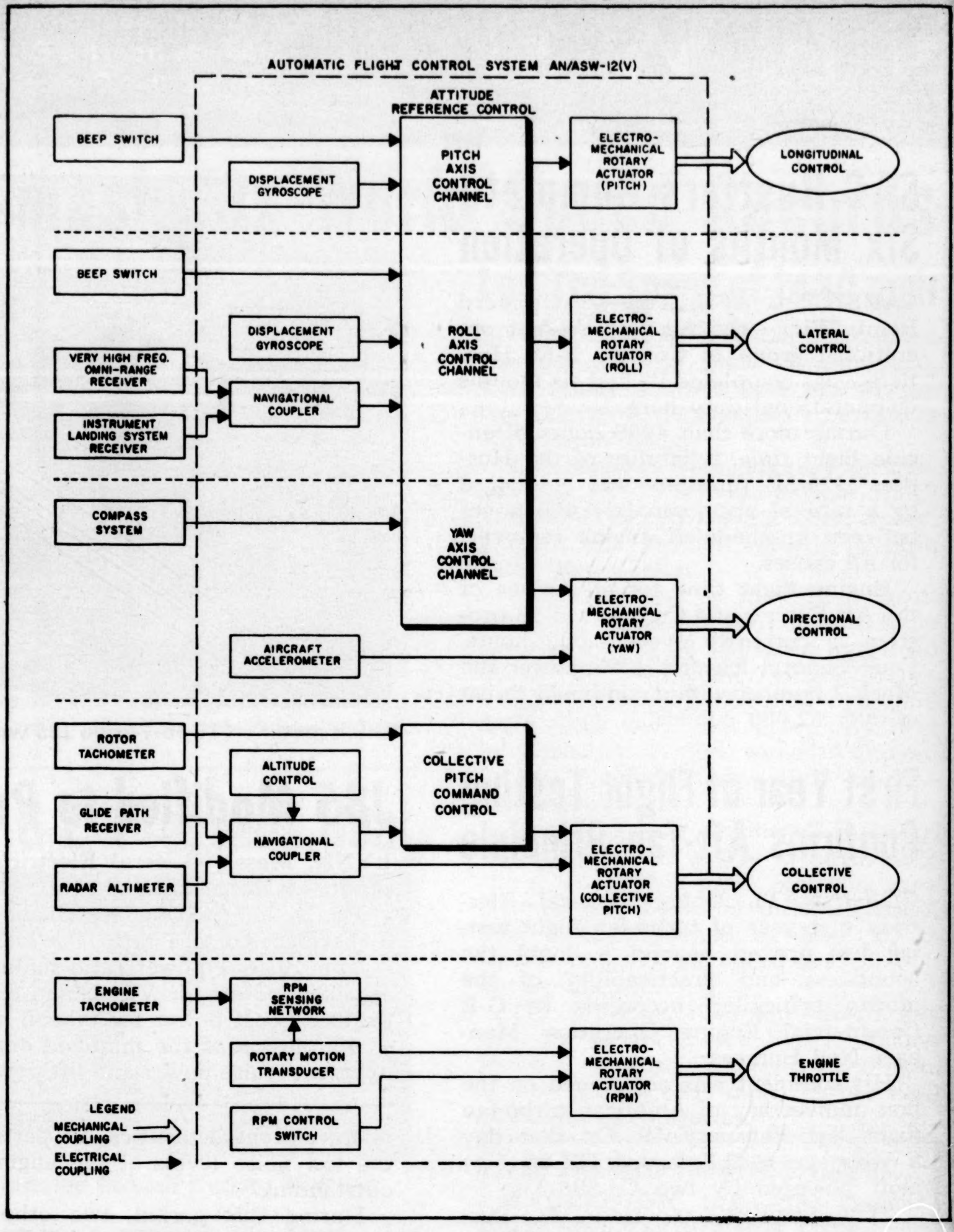
- **Flight controller**—Located in the cockpit, the controller permits the pilot to enter his commands into the autopilot. Roll commands are entered by turning a knob, pitch commands by advancing or retarding the knob. For pitch commands the gyro reference will change at a 2 deg./sec. rate. When the knob is released after pilot command it snaps back to its center position and gyro reference will hold the last position.

The controller also contains servo-effort indicators for comparing control surface movements with a fixed reference and a roll trim control.

- **Cockpit-mounted navigational** couplers (one for each system)—Coupler contains necessary switching and calibrating circuits to permit vertical and lateral navigation aids to be coupled to the autopilot. The coupler panel contains switches for pilot selection of constant barometric, radar altimeter or glide slope of the ILS (all in vertical mode). In lateral mode operation switches permit selection of automatic lateral control by magnetic compass heading, doppler radar, ILS localizer beam and VOR station.
- **Attitude reference control**—This unit, which consists of three synchros wired back-to-back with corresponding gyros, is an analog of the heading of the aircraft and can be made to respond as a model of how the airplane should react. The autopilot assumes the attitude commanded by the synchros. When the autopilot is disengaged, the reference control provides gyro synchronization in three axes.
- **Vertical gyro**—Completely self-contained gyro with module containing erection circuitry provides signals proportional to pitch and roll changes.
- **Accelerometer**—An accelerometer, a seismic mass in an oil bath, provides signals proportional to side accelerations for turn coordination. Pedal position is moved proportional to side acceleration.
- **Barometric altitude control**—Self-controlled unit provides signals proportional to deviations from selected barometric altitude.

Because of the more unstable characteristics of helicopters, the power units for rotary-wing systems are designed for differential, rather than the more straightforward parallel, actuation employed in the fixed-wing system, according to Kaufman. Differential actuation enables pilot commands to override autopilot commands.

This change and the need for other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BEEP SWITCH
DISPLACEMENT GYROSCOPE
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ELECTRO-MECHANICAL ROTARY ACTUATOR (PITCH)
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ROTOR TACHOMETER
ALTITUDE CONTROL
COLLECTIVE PITCH COMMAND CONTROL
GLIDE PATH RECEIVER
NAVIGATIONAL COUPLER
RADAR ALTIMETER
ELECTRO-MECHANICAL ROTARY ACTUATOR (COLLECTIVE PITCH)
COLLECTIVE CONTROL
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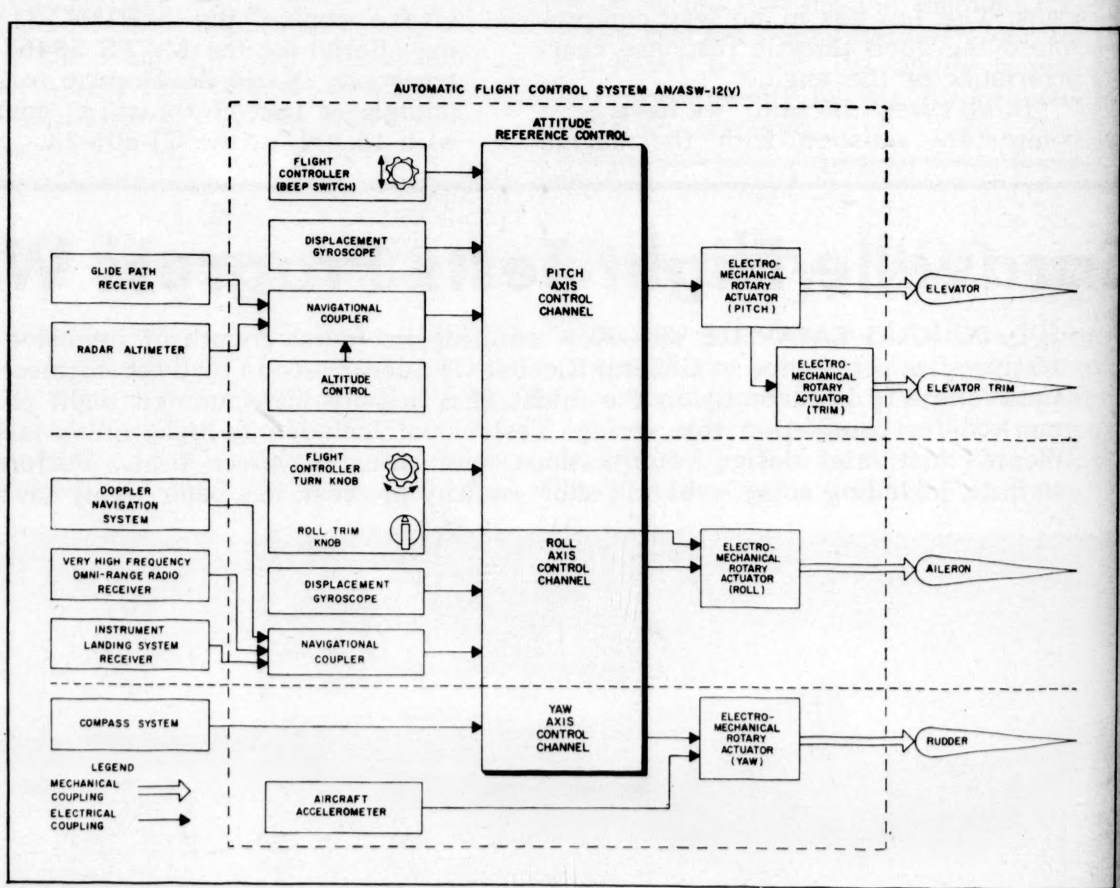
FLOW DIAGRAM for helicopter version of flight control system. Basically, the same modules employed in the fixed-wing system, augmented by a collective pitch command control, two linear actuators and a few other components, make up the helicopter system.


AUTOMATIC FLIGHT CONTROL SYSTEM AN/ASW-12(V)
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FLIGHT CONTROLLER (BEEP SWITCH)
DISPLACEMENT GYROSCOPE
GLIDE PATH RECEIVER
NAVIGATIONAL COUPLER
RADAR ALTIMETER
ALTITUDE CONTROL
PITCH AXIS CONTROL CHANNEL
ELECTRO-MECHANICAL ROTARY ACTUATOR (PITCH)
ELEVATOR
ELECTRO-MECHANICAL ROTARY ACTUATOR (TRIM)
ELEVATOR TRIM
FLIGHT CONTROLLER TURN KNOB
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ROLL TRIM KNOB
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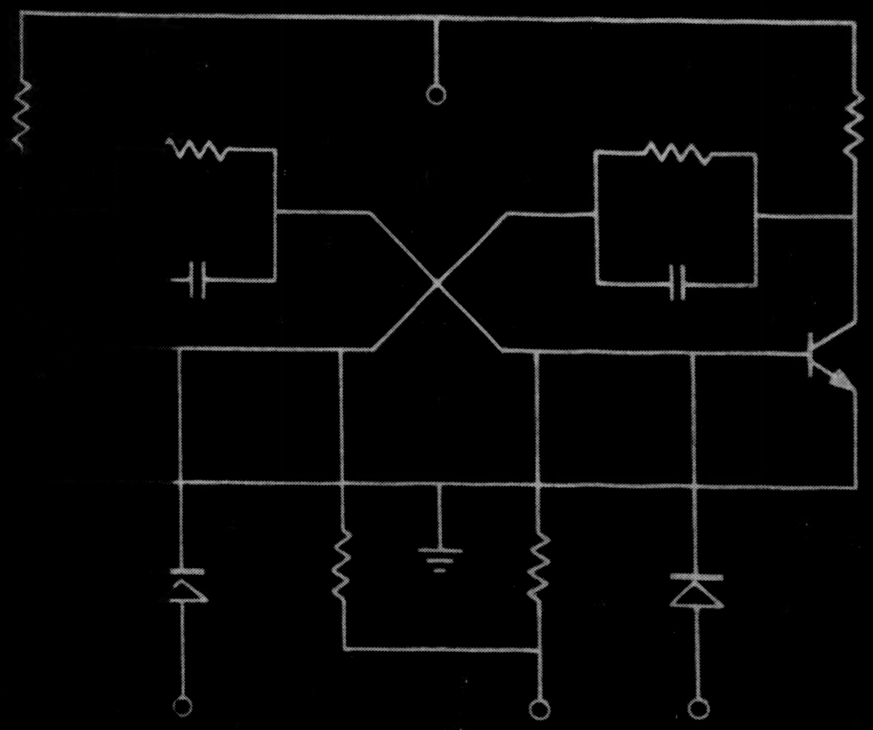
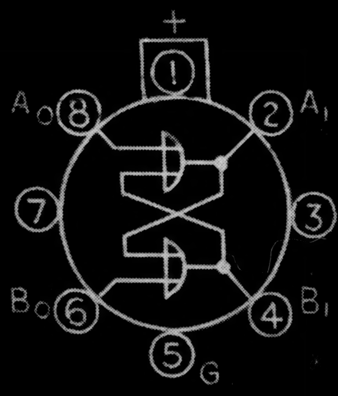
LEGEND
MECHANICAL COUPLING
ELECTRICAL COUPLING
AIRCRAFT ACCELEROMETER

FLOW DIAGRAM of Army's universal flight control system (fixed-wing) shows functionally required components for three-axis flight control.



A NEW SYMBOL



Worth learning because it represents a front-running achievement in microminiaturization. The symbol represents a microminiature "flip-flop." It is a solid-state integrated circuit incorporating all the functions shown in the equivalent conventional circuit. Yet it occupies one transistor package. It makes a 95% saving in space.

The symbol is one of six. There are a series of these functional micrologic elements: flip-flop, gate, buffer, half adder, half-shift register and counter adapter. Entire computer logic systems can be built wholly from combinations of these six building blocks. They are directly interconnectable. Design time is minimal.

The schematic is symbolic of the device. The physical realization of such a highly practical micrologic concept is symbolic of its maker—Fairchild Semiconductor Corporation. The company's repeated success in the development of advanced semiconductor devices has been based on the funded knowledge, abilities and esprit de corps of our entire staff. We are proud of our newest development. We are prouder yet of the creative approach of our scientific staff that accomplished it.

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controls require several deletions or alterations and some additions to the basic modules of the system. Output elements of the pitch and roll power units, for example, are designed for flexible shafts to accommodate different actuation techniques. Two linear actuators (screw jacks) are added while the power units for the other three helicopter axes are the same as in the fixed-wing system. The latter three power units control pedals (yaw), collective stick (vertical control) and rotor speed.

The flight controller employed in the fixed-wing aircraft does not appear in the helicopter system. Pilot commands for heading and attitude which were entered in the flight controller are integrated into the helicopter control stick. Besides the attitude reference control in both systems, a collective pitch command control is added for helicopters. This provides autopilot synchronization in collective pitch when the autopilot is not engaged and altitude reference when the autopilot is engaged.

Sensor units for the helicopter system are identical with those of the fixed-wing system and supplemented by a rotary motion transducer which measures the position of the collective stick. It anticipates power demands on the engine and advances the throttle accordingly.

An rpm. calibrator which contains an rpm. sensing network permits close control of the helicopter's blades. In tests with the Vertol H-21, for example, it demonstrated steady state accuracy to 10 rpm. (engine speed) and dynamic accuracy to 40 to 50 rpm. (engine speed).

A signal flow diagram for the helicopter version of the flight control system appears in an accompanying drawing. Five control channels—for three flight axes, collective pitch control channel (altitude) and engine rpm. are shown. When engaged the system provides attitude and heading and engine rpm. stabilization, altitude control and/or automatic path guidance. As in the fixed-wing system, each channel is electrically independent of the other, but roll and yaw are coordinated for banked turns.

Operation of one of five channels, collective pitch control, which maintains helicopter altitude, is as follows: The collective pitch power unit accepts signals from three sources—radar altimeter, barometric altitude control and glide path receiver. It then properly positions the collective pitch control.

When the barometric altitude control function is selected, signals are fed through the navigational coupler to the collective pitch power unit to maintain the helicopter's altitude. Similarly, glide path and radar altimeter signals can control approach or radar altitude if they are selected.

TI developed FM/FM transmitters and power supplies operated in "Ham" MERCURY spacecraft test. TI will supply FM/FM systems for later MERCURY shots.

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MISSILE ENGINEERING

Cornell Uses Long-Duration Shock Tunnel

By David A. Anderton

Buffalo—Cornell Aeronautical Laboratory is installing a hypersonic shock tunnel with test durations measured in seconds instead of milliseconds.

The new blowdown tunnel will have a test section large enough—about 50 sq. ft.—to handle large, nearly full-scale models of aerospace craft and will be capable of simulating the correct heat flux in hypersonic environments.

Test Mach number range will be between 6 and 15, with stagnation temperatures as high as 9,000R, at an airflow rate of 4.3 lb./sec. and test times up to 15 sec.

Cycling time for re-runs will be about four hours.

Reason for the long test time is the unique driving section of the tunnel. This is a wave superheater, a rotating assembly of 288 separate shock tubes, cycled once per revolution of the superheater. During every single rotation of the assembly, each of the shock tubes is cycled once with charge, driving, cooling and priming gas supplied from nozzles around the periphery. A complete cycle takes about 22 milliseconds.

Principle of the wave superheater has been investigated and proven on a small-scale unit, built and tested by Cornell under sponsorship of the Office of Scientific Research, Air Research and Development Command. Office of Scientific Research also sponsored the design study for the full-scale superheater about 20 months ago. The project was taken over by Advanced Research Projects Agency, with technical monitoring by ARDC's Arnold Engineering Development Center.

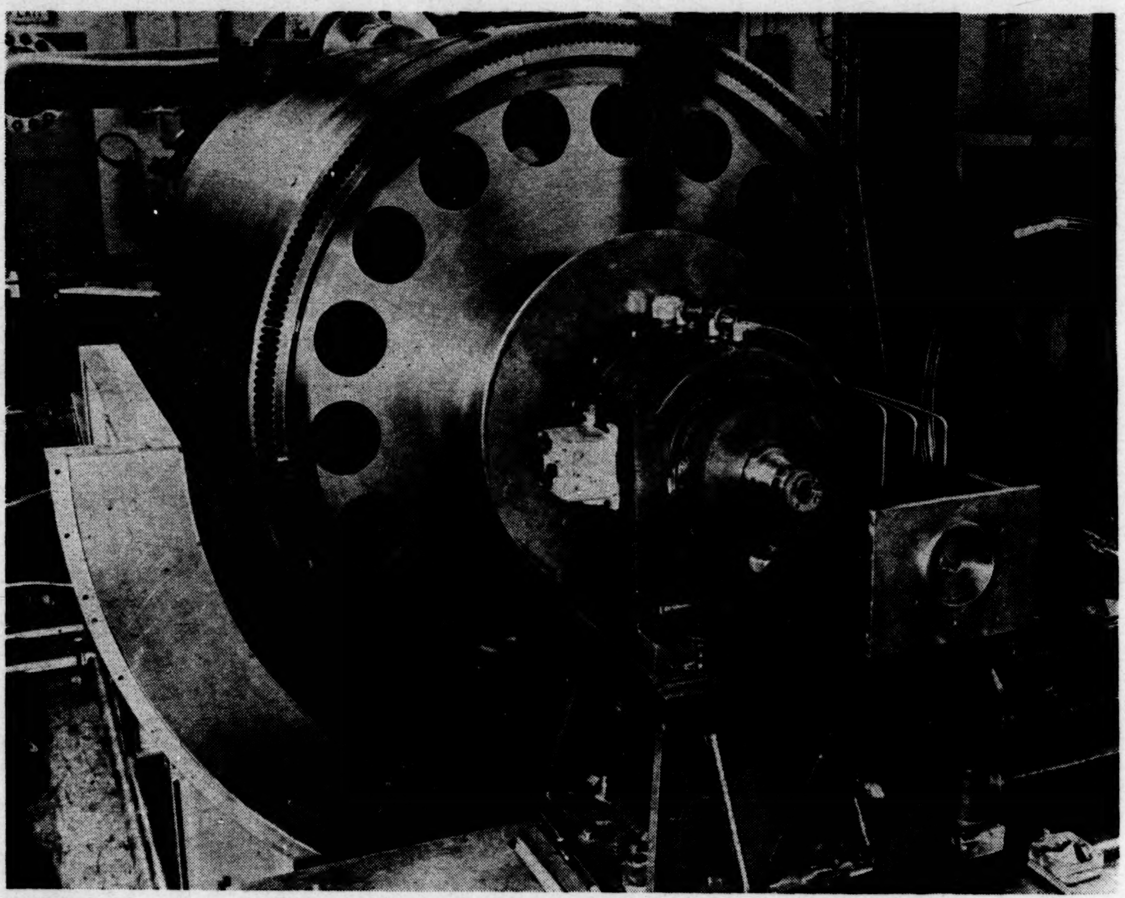
Rotor of the wave superheater has been installed at Cornell Laboratory, and the tunnel, now in shakedown and calibration runs, will be ready for Mach 6 tests by fall. Mach 15 capability is expected to be reached by July, 1962.

Shock Tube Cycle

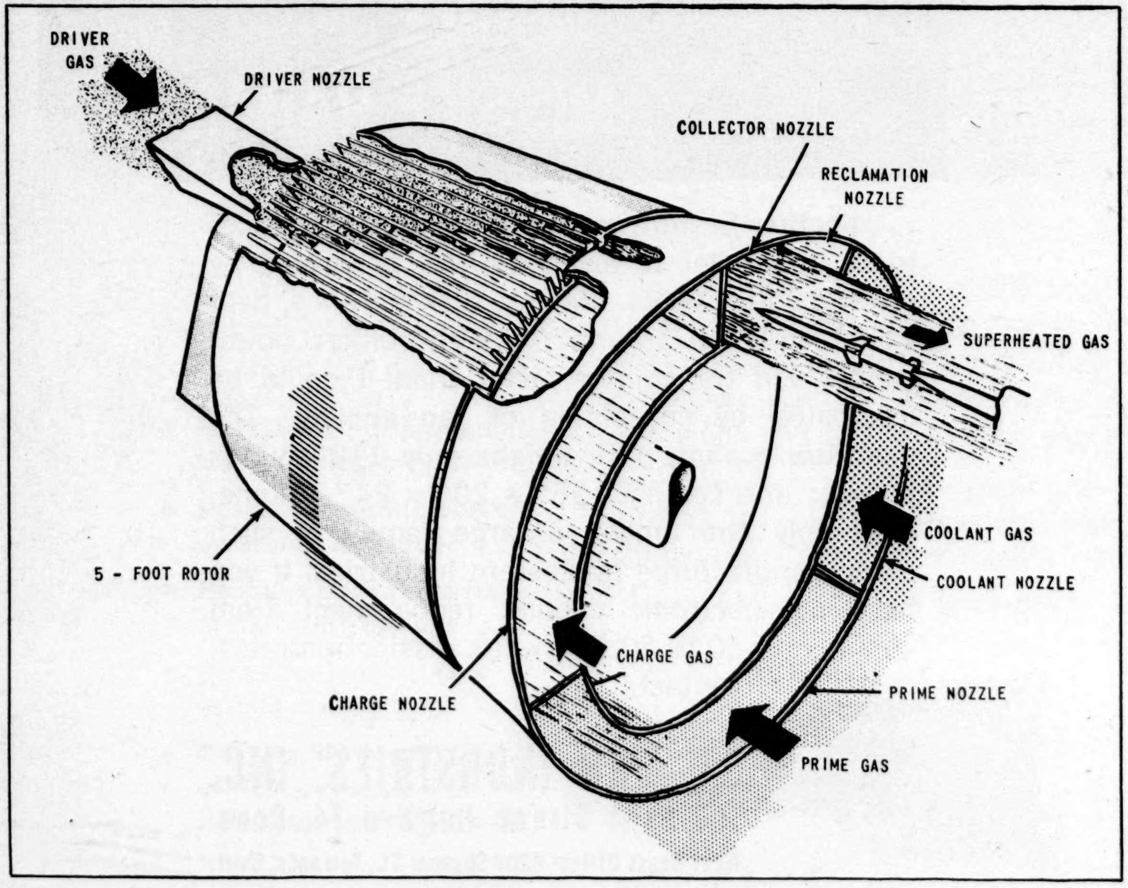
Each of the shock tubes in the rotor of the wave superheater operates just like a stationary shock tube. A moving piston of high-pressure gas (the driver) slams through the shock tube, creating a shock wave in the low-pressure gas (the charge) already in the tube. The shock wave compresses the charge gas, heating it and forcing it out of the tube. The compressed gas then expands through a nozzle to some test condition.

In a stationary shock tube, this process is started by the sudden rupture of a diaphragm separating the driver and charge gases. In the rotating assembly of shock tubes, the open ends pass by a series of nozzles at each end of the drum, to take in the driver gas at the upstream end, and to receive or discharge the appropriate gases at the downstream end.

The rapid passage of the open end past the nozzle—at a velocity of about 700 fps.—functions like the quick-open-



ROTOR of wave superheater, shown before shrouding, mounts 288 individual, small shock tubes to give continuous supply of superheated air for hypersonic wind tunnel.



SCHEMATIC DIAGRAM of wave superheater operation shows location of gas inlets during cycling. Complete cycle in individual shock tube takes about 22 milliseconds.

Rotor Design

Operation of the wave superheater depends on the rotating assembly of 288 shock tubes that furnish the slugs of high-temperature air to the collector nozzle. This rotor, which operates in a temperature environment of 700F, weighs about six tons, and rotates at speeds up to 2,700 rpm. to give a linear velocity at the shock-tube centerlines of about 700 fps. Tube centers are on a 2.5-ft. radius from the rotor axis.

The rotor was designed like a pure hoop, with no restraint on growth under stress. It is fabricated of three rings of forged Stainless W steel, originally formed in the largest melt and biggest forgings made in that material by U. S. Steel.

Final machining was the responsibility of the Twentieth Century Machine Co., Utica, Mich. The approach was to drill holes simultaneously from both sides of each ring and then bolt the three rings together on the inside.

It took more than a year to do the drilling and broaching job, as well as the other machining on this rotor. Drills, broaches and cooling mechanism for the job were specially designed and built. For the company, it was a "make-or-break" operation.

ing valve action of the ruptured diaphragm.

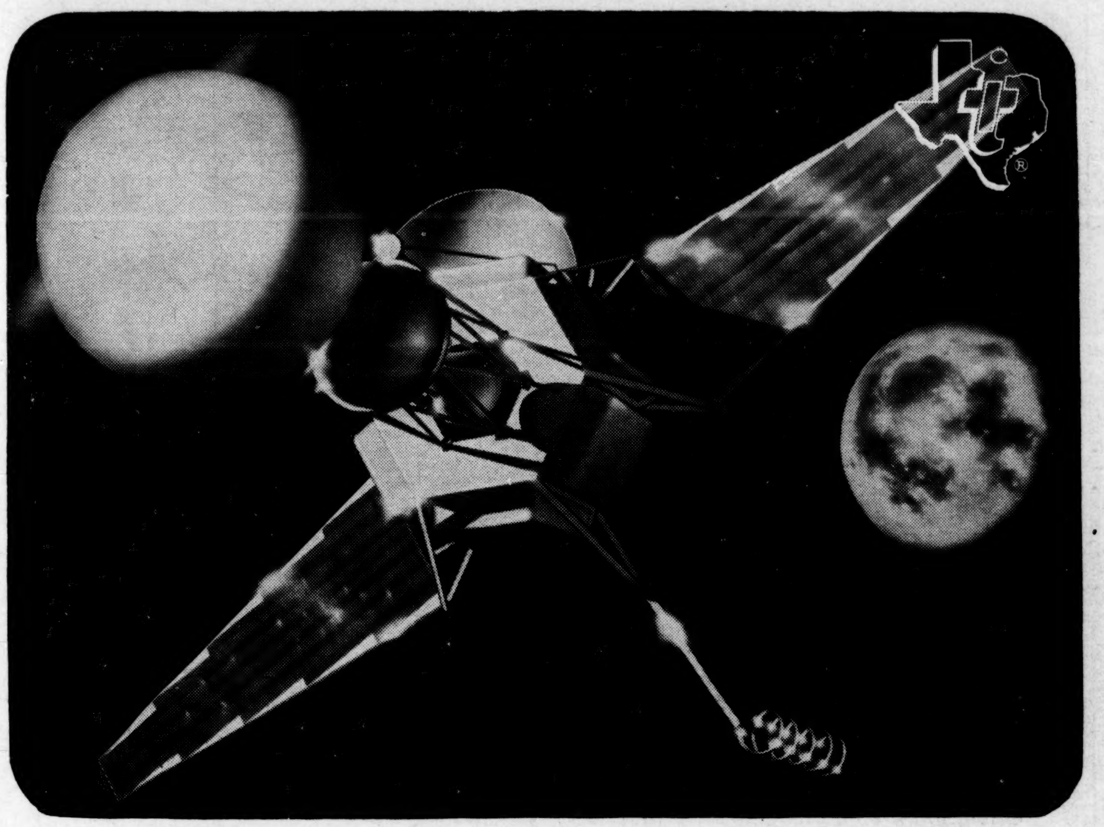
A complete cycle for one tube works this way:

The tube picks up a charge of preheated air from a downstream nozzle. It rotates past the upstream driver-gas nozzle and a slug of high-pressure helium blasts into the open end of the tube. The forced shock wave moves down the tube, followed by a slug of superheated air. The tube then rotates past a downstream collector nozzle and discharges superheated air into that nozzle.

At the next rotation station, the driver gas blows down into a reclamation nozzle, and continues to do so as it rotates until the driver gas pressure is down to about two atmospheres. At this point the downstream end of the tube is opened to the shroud around the rotor.

By the time the driven pressure in the tube has decreased to about one atmosphere, the tube has rotated to a coolant gas nozzle downstream. This nozzle feeds in helium and reverses the flow through the tube so that motion of the gas is now in an upstream direction.

Immediately after entry of the coolant, the tube passes in front of the fifth downstream nozzle which primes the tube with helium at rotor temper-



RANGER III — National Aeronautical Space Agency space vehicle for a United States lunar probe — uses digital command decoder developed and built by TI for the California Institute of Technology and Jet Propulsion Laboratory.

TI DECODERS IN SPACE EXPLORATION

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PROBLEMATICAL RECREATIONS 60

When I am as old as my father is now, I shall be five times as old as my son is now. By then my son will be eight years older than I am now. The combined ages of my father and myself are 100 years. How old is my son? *—The Week-End Book*

982 is the number of different transformers made by our Triad Division. These include transistor, instrumentation, toroidal, audio and microminiature transformers to name but a few. Bound to be several models in our Triad line of interest to you transformer people. Ask for Catalog TR-61—a tome packed with information—at: Triad Transformer Corporation, 4055 Redwood Avenue, Venice, California. Phone: UPton 0-5381.

ANSWER TO LAST WEEK'S PROBLEM: Denoting by X^3, Y^2, Z^3, respectively the ages of A, B, C, we have the equations: $X^3 = Y^2 + Z$; $Y^2 = Z^3 + X + 14$; $Z^3 = X + Y$. From these it is possible to obtain an equation of the 18th degree, but the only rational values of X, Y, Z can, with not too much difficulty, be obtained from the original equations. $X = 3$, $Y = 5$, $Z = 2$ and A is 27 years old, B is 25, C is 8.

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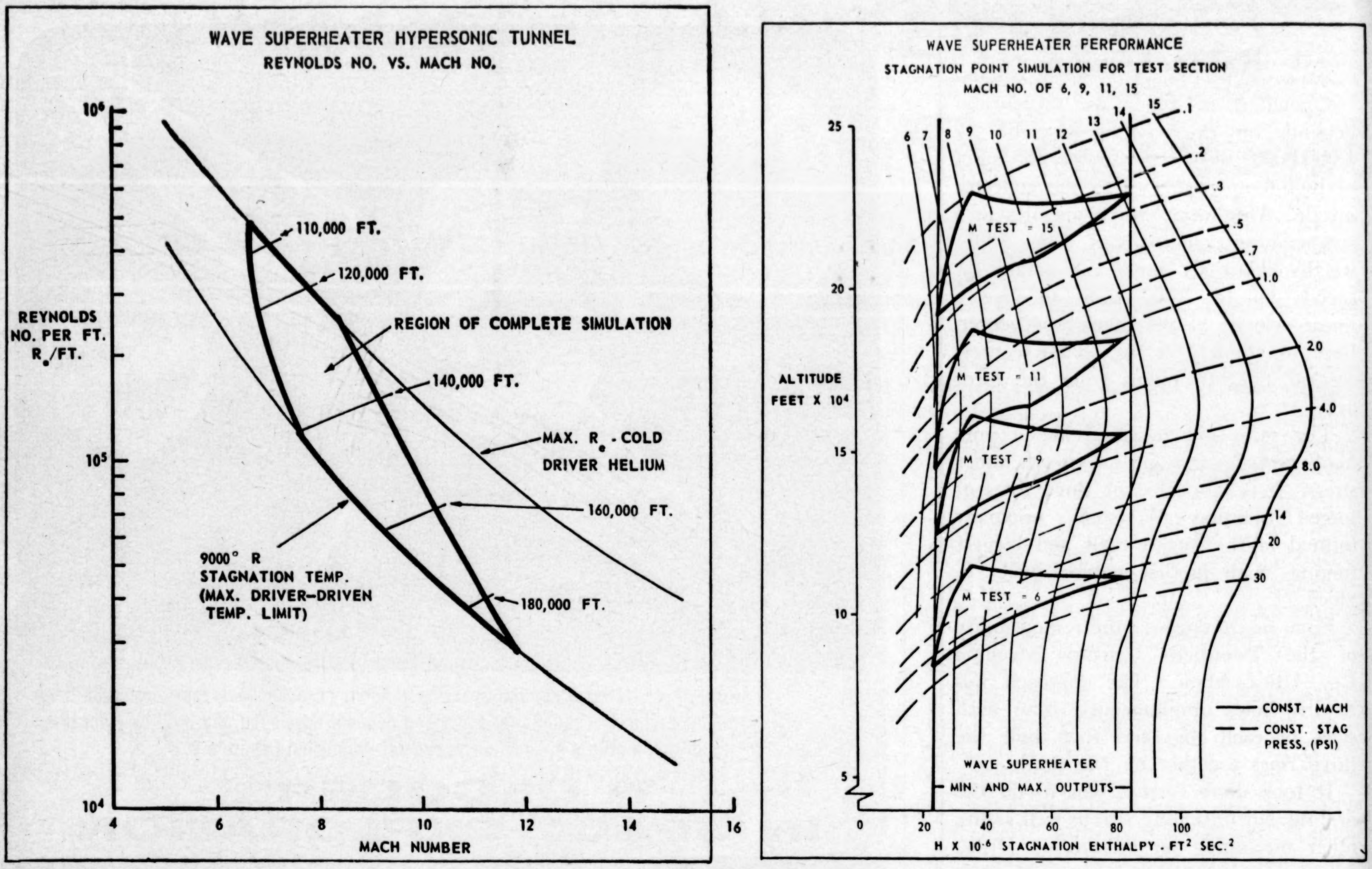
Beverly Hills, California



OPERATION MAP (left) of tunnel performance defines expanded output from the wave superheater. Portion within heavy lines is region of complete simulation; outside the borders and between maximum and minimum Reynolds' number curves, only Mach and Reynolds' numbers are simulated. Stagnation point simulation range is defined by this performance map (right).

ature. This gas establishes uniform flow conditions in the tube, readying it for the charge gas at the next point in the rotational cycle.

This entire cycle of charging, driving, collection, reclamation, cooling and priming takes about 22 milliseconds.

The high rotational speed of the superheater and the large number of shock tubes discharging at any one instant means that the flow at the collector nozzle is essentially steady. There was some worry about the wake from the trailing edge of each shock tube as it passes the collector nozzle, but theoretical studies showed that the wake would probably not exist after the gas had been expanded to Mach 6, lowest of the proposed test speeds.

Test Duration

Basically the wave superheater hypersonic tunnel is a combination of four blowdown units, one each for the charge air, and the driving, cooling and priming helium. Test duration is limited by the capacity of the gas storage units.

The driving helium is stored at 2,500 psi. in 60 high-pressure cylinders each of 23 cu. ft. volume. It is throttled by a fast-response valve that controls entry pressure as the helium goes into the pebble furnaces. These two furnaces are 7.5 ft. diameter x 12 ft. high; they raise the helium temperature to 2,160R. It flows to the nozzle through refractory-lined pipe.

Charge air is stored in 12 similiar high-pressure flasks, and is fed to a similiar pebble furnace. Throttle pressure at the furnace inlet is 600 psi. A second throttling reduces the pressure of the charge gas to 18.5 psia. before it enters the rotor shock tubes.

The cooling helium is also stored at 2,500 psi. in 46 high-pressure bottles, and is throttled down to a much lower pressure—on the order of several atmospheres, for example—before being let into the cooling nozzle.

Priming helium is stored at the same pressure in four flasks, and is heated to 1,260R in a small-capacity heater, and then throttled to about one atmosphere upstream of the priming nozzle.

All this operation with helium requires a flow of about 70 lb./sec. of the gas. It is not practical to waste that much helium, which means that the used gas has to be recovered and purified by removing the contaminating air. Collection is in two parts; the high-temperature, high-pressure, high-flow portion of the driving helium is collected by the reclamation nozzle. The rest of the mixed gas bleeds out into the sealed shroud around the rotor and nozzles.

These two batches of gas are cooled separately in aluminum-oxide pebble beds and then merged in a storage tank. The tank has 150,000-cu.-ft. capacity and is fabricated with an internal diaphragm which is collapsed before a run. The reclaimed gases expand to fill the diaphragm at atmospheric pressure during a run.

The purification cycle, separating the air from the helium and compressing and storing the helium in the high-pressure tank farm, takes approximately four hours, which therefore becomes the tunnel cycling time.

Test Instruments

First approach to instrumentation will be based on Cornell Laboratory's experience with its 24-in. hypersonic shock tunnel. Conventional pressure and temperature instruments, monitored by oscillographs, oscilloscopes or digital readout equipment, will comprise the bulk of the installation for operational definition of the test run.

An unusual stagnation-temperature probe using calorimetric principles was developed specifically for the wave superheater tunnel at Cornell Laboratory. In use, it measures the heat content of a portion of the superheated flow, and from this quantity, the stagnation temperature can be found.

Flow visualization will be done by shadowgraph and high-speed movie techniques, and closed-circuit television will be available.

WHO'S WHERE

(*Continued from page 23*)

Honors and Elections

William A. Patterson, president of United Air Lines, has been elevated to the rank of Officer in the French Legion of Honor by the French government in recognition of his ". . . achievements in the field of aeronautics and his efforts to improve the technical and scientific relationship between the United States and France."

The 6593rd Test Squadron (Special), Hickam AFB, Hawaii, the Air Force unit that made the first aerial recovery of an object from space orbit, has been selected to receive the Mackay Trophy for 1960.

In recognition of distinguished contributions to the national defense effort, the Arnold Air Society has presented the following awards for 1960: the Hoyt S. Vandenberg Trophy to **Lockheed Aircraft Corp.**; the H. H. Arnold Trophy to **Gen. Thomas D. White**, USAF, chairman of the Joint Chiefs of Staff; the Gen. Muir S. Fairchild Trophy to **Northrop Corp.**

Dr. Jerome B. Wiesner, President Kennedy's special assistant for science and technology, has been named the recipient of the Electronic Industries Assn.'s 1961 Medal of Honor for "distinguished service contributing to the advancement of the electronics industry."

Changes

John H. Wanner, general counsel, Civil Aeronautics Board, Washington, D. C., and **Joseph B. Goldman**, deputy general counsel. Also: **Robert L. Park**, associate general counsel, Opinion Writing Division.

Alfred H. Canada, manager of engineering, Raytheon Co.'s Santa Barbara, Calif., operations.

Solis Horwitz, director of the newly formed Office of Organization and Management Planning, Defense Department General Counsel.

George D. O'Gorman, assistant postmaster general for transportation, and **Christopher C. Scott**, deputy assistant postmaster general for transportation.

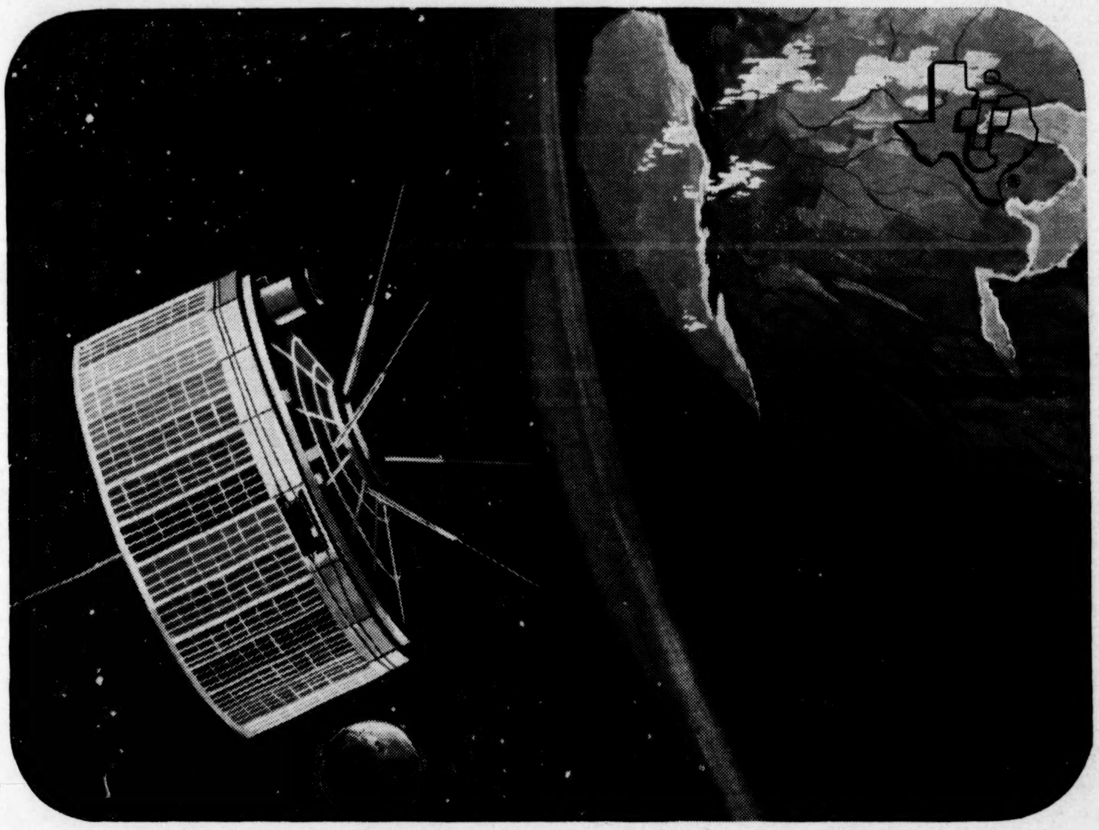
Carlos V. Pellerano, general sales manager, Varig Airlines, succeeding **Eduardo Schoueri**, now assistant to the president.

Theodore P. Snow head of the newly established Huntsville, Ala., office of Boeing Airplane Co.

Dr. Morris Handelsman, associate director of advanced military systems, Defense Electronic Products, Radio Corp. of America, Camden, N. J.

William Lawrence, general manager, San Diego, Calif., facilities of General Dynamics/Electronics' Military Products Division, and **Howard L. Gates**, manager-operations.

General Electric Co.'s TEMPO component at Santa Barbara, Calif., has been reorganized and the following appointments announced: **T. A. Kvaas**, manager-Professional Staff Operations; **Harry R. Bradley**, manager-Program Operation; **Brig. Gen. H. O. Paxson**, manager-Review Operation; **David P. Wilkinson**, head-Business Planning Operation; **Klaus G. Liebhold**, head-Technical Information Operation; **L. R. Marsh**, manager-Relations and Utilities Group.



TI electronic flight control in Douglas Aircraft's Delta launch vehicle helped orbit the NASA weather satellite TIROS II.

TI FLIGHT CONTROLS IN SPACE EXPLORATION

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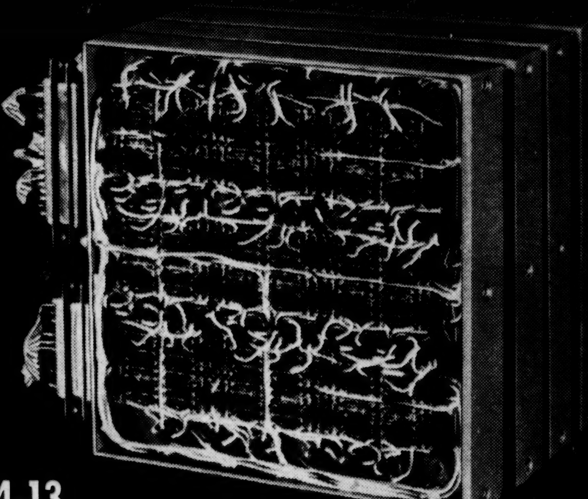

RIDL Model 34-13

The RIDL Model 34-13 is a special purpose Pulse Height Analyzer with time base Multiplexing storage and transmission ability. It may be used to measure and store low level signals from transducers linked with any type of sensing element or from any type of radiation equipment.

as analyzer

The Model 34-13 is a complete laboratory instrument, capable of analyzing pulses of varying amplitude — of storing data for short or extended periods of time — and of relaying information through either redundant or destructive readout through a telemetering system. Data is quickly cleared from the memory in preparation for a new cycle of analysis, storage, and readout.

as multiplexer

The Model 34-13 may be used as a serial input multiplexer — starting with such information as that from human factors engineering systems, thermocouples, strain gauges, pressure gauges, power indicators and yaw indicators — and of recording, switching, or storing digitized information to be read out on program or command.

A major feature of the 34-13 is its fast transmittal time. Data may be read out two or three channels at a time, taking only the most and least significant data bits. Maximum and minimum limits may be set — down to 0.05 millivolts and up to 5 volts (the equivalent of 2 Mev particles).

Power Consumption: 1 watt
Temperature Range: —10°C. to +55°C
Channel Width: 1% of full scale
Size: 5"x6"x6"
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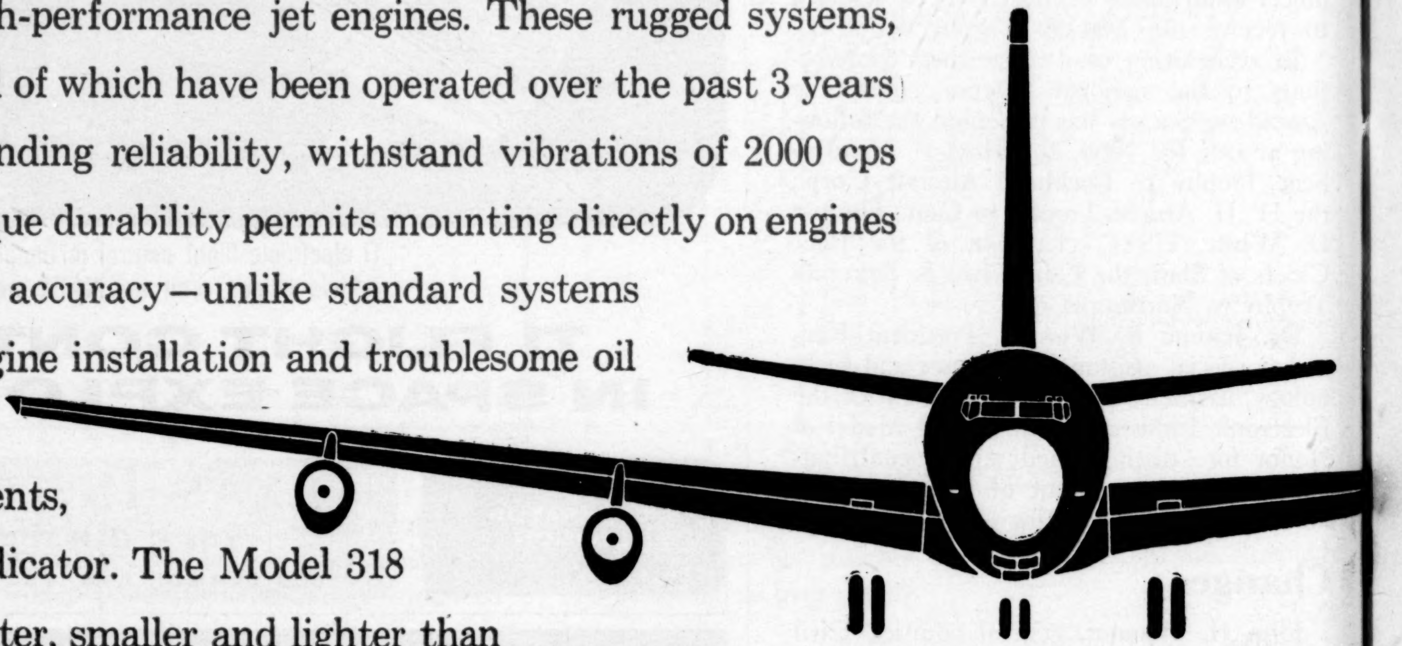

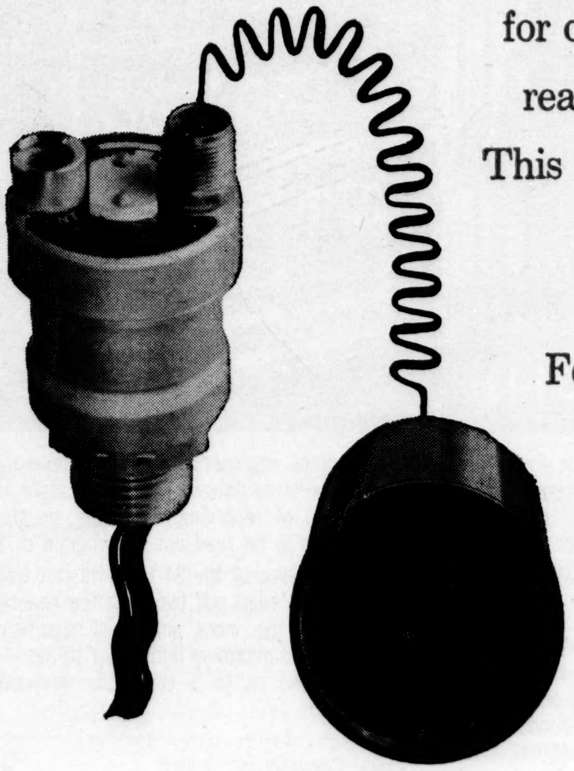

Standard hermetically sealed indicator, available in 1½" and 2". Model 296, a 2" indicator, is integrally lighted: in daylight, numerals and pointer are white and at night red. When power is off, pointer will move off-scale below zero.

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FINANCIAL

Stock Transactions

The Securities and Exchange Commission's Summary of Security Transactions and Resultant Holdings for the period Dec. 11, 1960, to Jan. 10, 1961, reported the following transactions by two shareholders of General Precision Equipment Corp.: acquisition of 9,100 common shares by the Martin Co., beneficial owner, making a holding 203,400 (AW Feb. 27, p. 28); acquisition of 300 $4.75 preferred shares, held indirectly, by John C. Maxwell, director, and disposition of 300 $4.75 preferred shares, his total indirect holding.

Other transactions for the period Dec. 11, 1960, to Jan. 10, 1961, include:

Aerojet-General Corp. Disposition of 600 common shares by John V. Atanasoff, officer, leaving a holding of 216.

All American Engineering. Acquisition of 1,000 common shares, held indirectly, by Harry W. Lunger, director, making an indirect holding of 1,000 (direct holding remains 8,240); acquisition of 300 common shares by Stanley W. Smith, officer, making a holding of 300.

Allegheny Airlines, Inc. Acquisition of 5,700 common shares by Leslie O. Barnes, officer, making a holding of 29,700; acquisition of 200 common shares by Nelson B. Fry, Jr., officer, making a holding of 400; acquisition of $3,000 of convertible subordinated debentures by Leslie O. Barnes, officer, making a holding of $3,000.

American Bosch Arma Corp. Disposition of 1,500 common shares by F. William Harder, director, leaving a holding of 8,600.

Associated Testing Labs. Disposition of 1,700 common shares by Bernard Novack, officer, director and beneficial owner, leaving a holding of 95,300; disposition of 1,700 common shares by William Tonkowich, officer, director and beneficial owner, leaving a holding of 95,300.

Atlantic Research. Disposition of 800 common shares by Presson S. Shane, officer, leaving a holding of 15,090.

Avco Corp. Acquisition of 1,000 common shares by Henry J. Oechler, officer, making a holding of 2,000; disposition of 500 common shares by Curry W. Stoup, officer, leaving a holding of 9,220.

Avien, Inc. Acquisition of 10,500 Class A capital shares through exercise of option by William O. Boschen, director, making a holding of 10,600.

Avnet Electronics Corp. Disposition of 28,000 common shares by Charles Avnet, officer and director, and acquisition of 100 common shares, making a holding of 204,921 (indirect holding remains 1,262); disposition of 54,000 common shares by Lester Avnet, officer and director, and acquisition of 100 common shares, making a holding of 295,643 (indirect holdings remain 2,939); acquisition of 445 common shares through exercise of option by Louis A. Tepper, officer and director, making a holding of 2,216.

Beech Aircraft Corp. Disposition of 200 common shares by J. A. Elliott, officer and director, leaving a holding of 4,708; disposition of 300 common shares by Lee O. Higdon, officer, leaving a holding of 1,275.

Boeing Airplane Co. Disposition of 1,300 capital shares by Don R. Berlin, officer, leaving a holding of 15,010; disposition of $1,000 of 4½% subordinated convertible debentures by Robert H. Jewett, officer, leaving a holding of $3,300.

Braniff Airways, Inc. Acquisition of 500 common shares by Oscar W. Crane, officer, making a holding of 713; disposition of 1,000 common shares, his total indirect

U. S. Army L23D produced by Beech Aircraft—equipped with AN/APQ-86 all-weather, high resolution reconnaissance radar, developed and built by TI in cooperation with the U. S. Army Signal Corps.

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HUGHES

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AEROSPACE ENGINEERING DIVISION

holding, by Milton McGreevy, director (direct holding remains 3,000).

Capital Airlines. Disposition of 2,610 common shares, his total holding, by James R. Stockton, director.

Chance Vought Corp. Acquisition of 300 common shares by Dwight L. Simmons, director, making a holding of 400; disposition of 100 common shares, his total holding, by W. P. Thayer, officer.

Chrysler Corp. Disposition of 6,800 common shares by J. T. Trippe, director, leaving a holding of 200; acquisition of 600 common shares by L. I. Woolson, officer and director, making a holding of 1,013.

Collins Radio Co. Disposition of 1,000 common shares by Lester E. Bessemer, officer and director, leaving a holding of 416 (indirect holding remains 425); disposition of 200 common shares by John B. Tuthill, officer, leaving a holding of 316.

Continental Air Lines. Disposition of 2,000 common shares by Lawrence C. Ames, director, leaving a holding of 5,200; acquisition of 500 common shares by Frederick L. Ehrman, director, making a holding of 10,000; disposition of 1,000 common shares by Mark Kramer, officer, leaving a holding of 575; acquisiton of 200 common shares by Harding L. Lawrence, officer and director, making a holding of 1,125; disposition of 5,000 common shares by Robert J. Smith, director, leaving a holding of 225; acquisition of $10,000 of 5⅝% subordinated convertible debentures by Lawrence C. Ames, director, making a holding of $60,000.

Daystrom, Inc. Disposition of 100 common shares, his total holding, by Kenneth H. Klipstein, director; disposition of 100 common shares, his total holding, by John W. McLaren, officer.

Eastern Air Lines. Acquisition of 100 common shares by Malcolm A. MacIntyre, officer and director, making a holding of 100; disposition of 246 common by Frank Sharpe, officer, leaving a holding of 569.

Electronic Communications. Acquisition of 1,000 common shares by Edward F. Coy, officer, making a holding of 1,000.

Ford Motor Co. Disposition of 2,000 common shares by Ernest R. Breech, director, leaving a holding of 53,000; disposition of 23,215 common shares*, his total holding, by, Robert S. McNamara, officer and director (*does not include Employees Savings & Stock Investment Program shares).

Garrett Corp. Acquisition of 230 common shares through conversion by Eli Barlow, officer and director, making a holding of 16,196; acquisition of 230 common shares through conversion by K. B. Wolfe, officer and director, making a holding of 343; disposition of $10,000 of convertible debentures, his total holding, through conversion by Eli Barlow, officer and director; disposition of $2,000 of convertible debentures, his total holding, through conversion by C. W. Leinbach, Jr., officer; disposition of $10,000 of convertible debentures, his total holding, through conversion by K. B. Wolfe, officer and director.

General Dynamics Corp. Disposition of 100 common shares by Lisle W. Adkins, officer, leaving a holding of 300.

Greer Hydraulics, Inc. Acquisition of 1,000 common by David Fromson, officer and director, making a holding of 1,100.

Grumman Aircraft Engineering Corp. Disposition of 1,000 common shares by L. R. Grumman, director, leaving a holding of 128,940.

Hiller Aircraft Corp. Acquisition of 24,300 capital shares by Electric Auto-Lite, beneficial owner, making a holding of 81,300; disposition of 181 capital shares by Malcolm E. McAlpin, director, leaving a holding of 1,275, and acquisition of 205 capital shares, indirectly held, making an indirect holding of 12,750.

Litton Industries. Disposition of 1,600 common shares by Fred R. Sullivan, officer and director, leaving a holding of 13,660; disposition of 1,000 common shares by Charles B. Thornton, officer and director, leaving a holding of 283,151 (indirect holding remains 31,191).

Lockheed Aircraft Corp. Acquisition of 1,632 capital shares through exercise of option by Roger B. Smith, officer, making a holding of 1,632.

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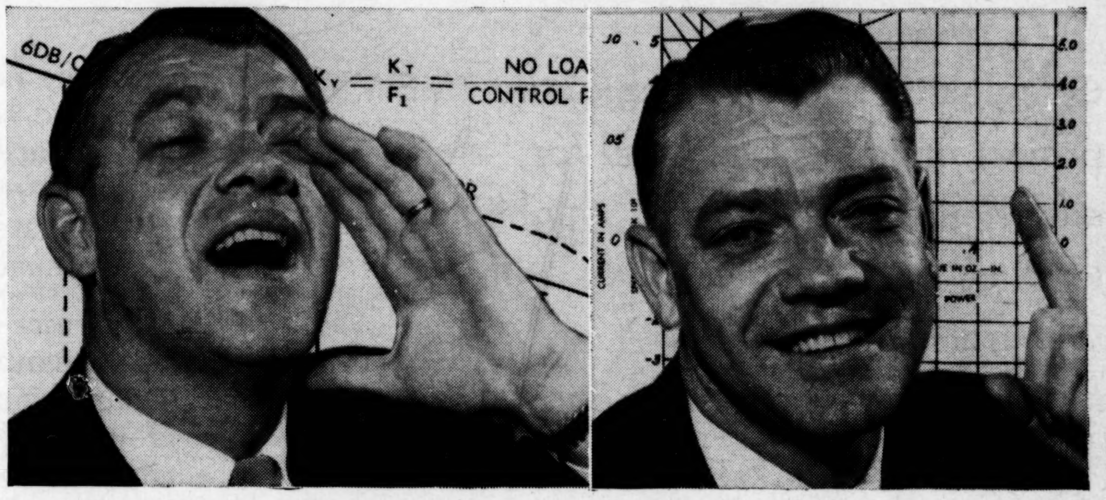

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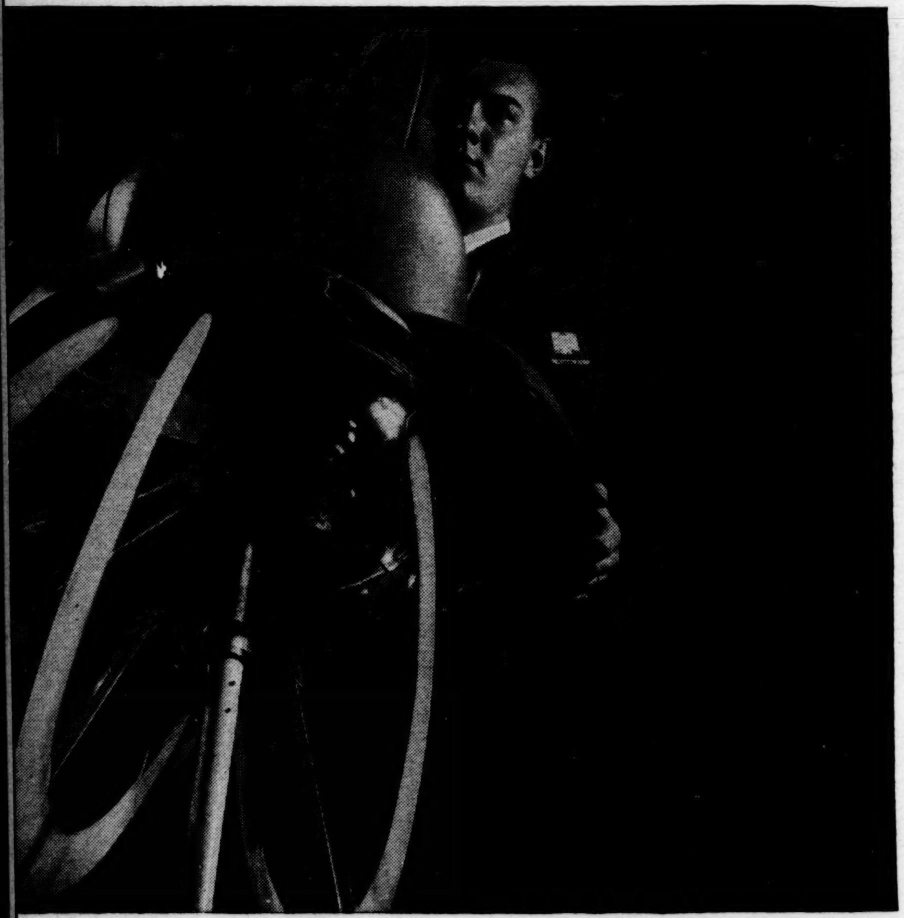
NEEDED: more Electronics Engineers qualified to work on advanced missile detection systems

Complexity of, for example, the BMEWS project, indicates the need for experience, competence...highlights the kind of opportunities open with General Electric's Missile Detection Systems Section.



FUTURE DEFENSE, SPACE PROBLEMS

Future-generation space vehicles will necessitate even more sophisticated detection systems. The creation of such systems is the job of the Advanced Radar Systems Development Engineer. Qualifications are high . . . but the rewards are in keeping—the opportunities for advancement excellent.

Within the next ten years the need for qualified engineers and scientists will quadruple in the field of missile, space-probe and satellite detection. This prediction is made by General Electric's Missile Detection Systems Section, based on present and anticipated space vehicle state-of-the-art.

And because of this, there is a possibility that a technical manpower "vacuum" may develop in what many consider to be one of the most vital, fast-growing technologies of the space age. What's needed are more engineers who can meet the strict requirements. For example . . .

It takes a unique kind of engineer to work in the field of detection. An Advanced Systems Engineer must be extremely competent technically. Yet, he must also be something of a "dreamer"—able to anticipate and define future *problems* as well as conceive practical systems *solutions.* To do this, he must keep abreast of virtually every significant advancement, not only in his own, but in other fields.

The same holds true for Equipment Specialists who must meet exacting detection-system specifications. Yet, there are relatively few related fields where this kind of specialized experience can be obtained.

BMEWS is a good example of the magnitude of system and equipment requirements. Its 66,000 square-foot antenna reflectors had to be engineered to hold a ¾ of an inch tolerance over a 150° tem-

PROVIDING 15-MINUTE WARNING

BMEWS' massive radar reflectors are indicative of the system's complexity. According to MDSS four electronics engineers will be needed within the next decade for every one now working on such systems.

Ling-Temco Profit Rose in 1960; Company Is Optimistic About 1961

Dallas, Tex.—An "optimistic outlook" in 1961 is seen for Ling-Temco Electronics' business domestically and abroad by Board Chairman Robert McCulloch and President James J. Ling.

They reported that net earnings for the firm after taxes in 1960 totaled $3,051,172, up slightly from the previous year's $3,029,550. Last year's sales totaled $148,447,484, down only slightly from 1959's $148,723,916, despite the loss of some $16 million in planned sales as a result of Navy cancellation of the company's major missile program, Corvus, last July and revision of the contract to a research and development level (AW July 25, p. 35).

Per share earnings of the company in 1960 were $1.25, including 11 cents of non-recurring income, compared with $1.22 the previous year which included 18 cents of non-recurring income. McCulloch and Ling told stockholders that the company is continuing a policy of re-investing earnings, thus passing divided payments.

Good earnings were experienced in the third and fourth quarters, despite general business contraction due to the recession. For 1960, Ling-Temco sales showed this breakdown, pointing up results of its emphasis on electronics and aerospace systems: electronics, communications, missiles and aerospace systems accounted for $117 million or about 79% of its activities, airframe components, $25 million, or about 17% and all other categories, $6 million, or about 4%. Electronics and aerospace systems business last year increased $2 million over the previous year for a gain of 21%.

Ling-Temco backlog, including letters of intent and contracts under negotiation, totals more than $100 million, the company reported.

Shareholders' total equity increased by $4,277,914 last year to a total of $28,532,956, largely because of retention of dividends. Total assets increased $26,426,350 to $93,459,633, with working capital at $22,558,484 as of Dec. 31, 1960.

The company had, effective Dec. 1, a new line of credit of $27.5 million, superseding prior loan agreements. It reports that it plans no additional equity financing.

The financial statement makes note of the fact that Ling-Temco has acquired 21% of Chance Vought Corp.'s outstanding stock—additional holdings by Ling-Temco President James J. Ling and associates actually bring this holding to some 38% and this is currently the subject of a suit filed by Chance Vought in federal court alleging violation of anti-trust laws. Ling has filed counter-suits protesting a recent Chance Vought acquisition and also for the purpose of obtaining a list of Chance Vought stockholders. Chance Vought directors have moved their stockholders meeting back from Apr. 18 to May 28. Ling-Temco's stockholders will meet Apr. 10 (AW Mar. 6, p. 36).

The company notes that its research and development expenditures last year were some $2,846,348 plus approximately $6 million expended by its industrial and military customers on new products.

Highlighting research programs under way by the company were:

- **Development of Iconorama** information display system to include missile debris plotting systems and the Nike Zeus in its intercept mission.
- **Underwater-operating** high-power air-modulated loudspeakers, for use as warning and long-range oral communications systems.
- **Electromagnetic space reconnaissance** is being studied under a classified contract. Electronics research laboratory is studying molecular electronics, among other sciences.
- **Use of the electro-dynamic** vibration principle in the drawing of metal tubes and increasing the transportability of solid rocket fuels was under study by the company as well as a variable spring-rate gun mount and a high-power transducer for low-frequency sonar.

Ling-Temco executives also reported to stockholders these areas of interest in which the company expects to expand its efforts in 1961:

Equal emphasis will be placed on the commercial-consumer market for electronics as well as on military applications, considering that estimated electronics industry volume this year of some $10.5 billion—an 8% increase over 1960—is nearly evenly split between these markets. The firm says that it will accelerate efforts for applications of electronics in the commercial-consumer fields—beyond the original military functions—for many products.

Ling-Temco plans to step up its efforts in such fields as radio astronomy, which it views as a major future market. It reports that indications are that there is need for another very low frequency radio station similar to the one it constructed in Cutler, Me., for the Polaris system. It has proposed a VLF system for a hardened installation as a result of an invitation from USAF, and the British government has invited a proposal for a NATO VLF installation in England.

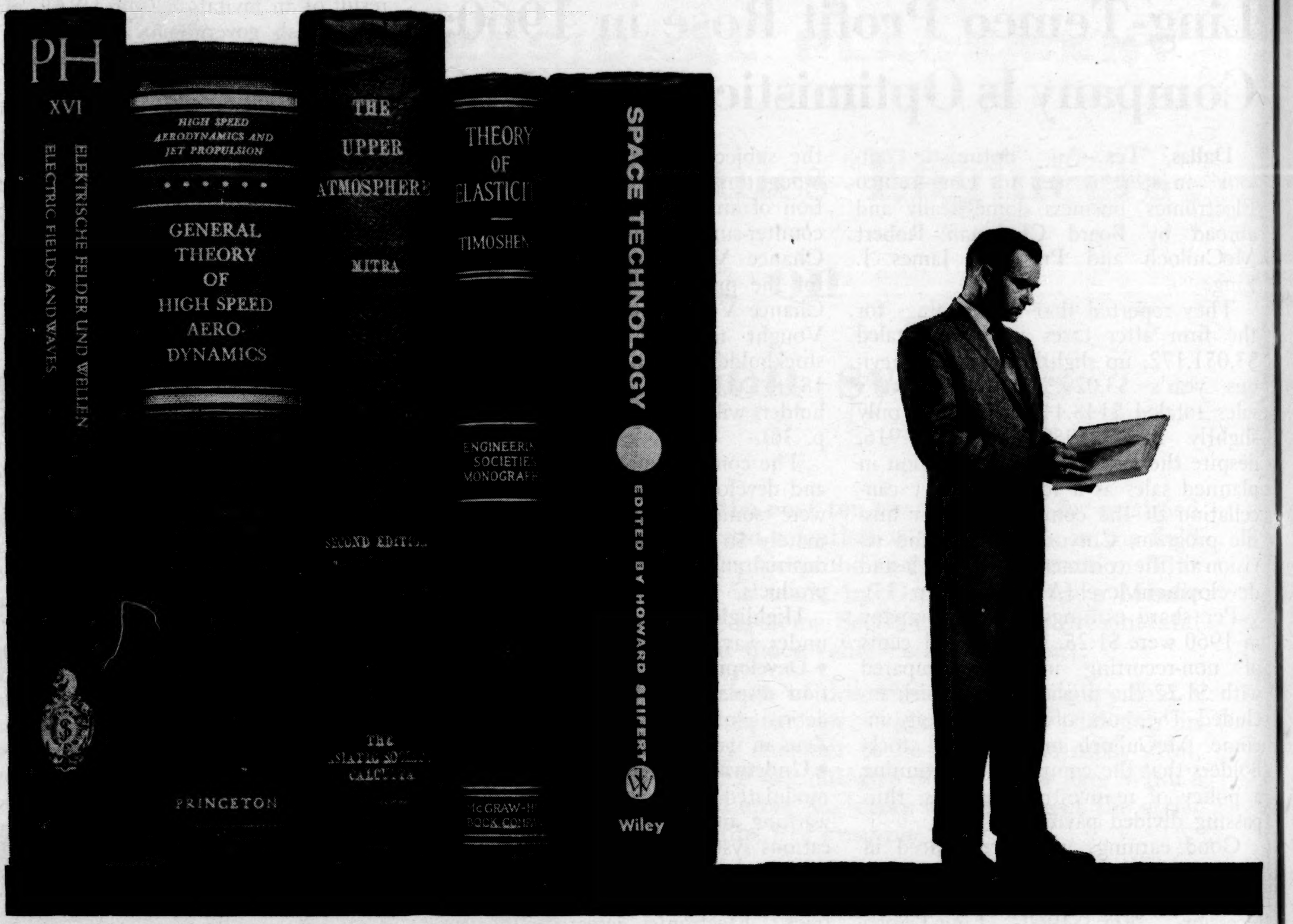
The company foresees, marked increase in requirements for sonar systems in aerospace vehicles as well as submarines, surface vessels and shore stations and envisages sonar subsystems following the history of radar subsystems.

New Offerings

American Machine & Foundry Co., New York, N. Y.; the company and its subsidiaries manufacture, sell and lease a diversified range of products for consumer and industrial use, and also perform a substantial amount of contract engineering and manufacturing relating principally to the defense program of the U. S. (missile ground support). Offering is $40.5 million of convertible subordinated debentures, due Mar. 1, 1981, for subscription by company stockholders on the basis of $100 principal amount of debentures for each 20 shares of common stock; record date, subscription price and underwriting terms to be supplied by amendment. Proceeds will provide additional working capital to finance the company's expanding business and will be applied to the payment of all outstanding short-term loans, which at Dec. 31, 1960, aggregated $31 million, such loans were made to meet the cash requirements of the company's increased investment in inventories, accounts receivable and overseas operations.

Copter Skyways, Inc., Pittsburgh, Pa., organized in August, 1960, for the purpose of developing the commercial uses of helicopters in the Pittsburgh area. In September, 1960, it acquired all the stock of Pittsburgh Airways, Inc., said to hold a certificate for transportation of persons and property by helicopter between Bradford through DuBois, Johnstown and Somerset to Meyerdale, Pa. Offering is 15,000,000 shares of no par common stock, for public sale at 3 cents per share. Company proposes to apply the proceeds to the acquisition of all the basic equipment, property and capital deemed necessary to commence business, including $150,000 for a helicopter and $65,000 for a base of operations..

Rocket Research Corp., Seattle, Wash., organized under Washington law in 1959, and to date primarily engaged in research on new high energy propellant systems, the development of a miniature rocket for application to satellite and space vehicles and a rocket-powered pump, and in the preparation of proposals which have been submitted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to certain governmental agencies. Offering is 300,000 shares of common stock, for public sale at $2.25 per share. Of the proceeds, $150,000 will be used for research-development programs; $215,000 for acquisition of new offices, laboratory, manufacturing facilities, instrumentation and tooling equipment, ship and test machinery and devices, office furniture, and for a remote rocket test facility including equipment; $20,000 for repayment of a loan from the principal underwriter; $115,000 for working capital for research sponsored by government agencies and for manufacturing operations; the balance for future research, development and manufacturing activities and required plant and facilities expansion.

Custom Components, Inc., Caldwell Township, N. J., engaged in the development, design, manufacture and sale of magnetic-powered iron or polyiron cores for radio and television and a diversified line of permeable dielectrics for microwave systems. Offering is 165,000 shares of common stock, for public sale at $3 per share; at least 100,000 shares must be sold within 60 days after the date of the offering or none of such shares will be issued or sold. Of the proceeds, $100,000 will be used for the commercial manufacture of ferrites, including the purchase of equipment and the creation of an inventory: $100,000 to expand the businesses of Microwave Components, Inc., and Pennsylvania Testing Laboratories, Inc., which are to be acquired by the company by an exchange of stock in the event this offering is successful, and the creation of a new testing facility to be built at the company's plant in New Jersey; $38,333.81 to retire remaining indebtedness incurred through the purchase of 30% of the company's outstanding stock for an aggregate $120,000, which stock was retired by the company; the balance will be added to general working funds.

Dynatronics, Inc., Orlando, Fla., engaged in the design, manufacture and sale of electronic equipment and systems, including antenna, digital and timing systems. Offering is 120,000 shares of common stock for public sale, offering price and underwriting terms to be supplied by amendment; an additional 60,060 common shares are to be offered at $1.75 per share to holders of outstanding bearer warrants. Of the proceeds, $200,000 will be used to reduce current bank borrowings; $50,000 for the purchase of new test equipment and the erection and equipping of additional manufacturing facilities on its leased premises; the balance to provide working capital.

Dynamic Instrument Corp., Westbury, N. Y., engaged in the design, manufacture and sale of electro-magnetic clutches and brakes and in the machinery of precision instrument components on a subcontract basis; the majority of the company's products is sold to and the work performed for defense industries. Offering is 150,000 shares of common stock for public sale at $2 per share. Of the proceeds, $64,000 will be used for repayment of certain indebtedness; $50,000 to complete the development of a production model of a servo motor and to develop commercial models of clutches and brakes; the balance will be added to working capital and used to finance the purchase of materials, components and a finished goods inventory.

Financial Briefs

Vitro Corp. 1960 consolidated net income was $723,411, a rise of 28% over 1959's figure of $565,252. Revenue for 1960 totaled $58,118,193 compared with $60,301,229 for 1959.

General Controls Co. net earnings in 1960 amounted to $1,090,111, a sizable drop from $1,612,975 earned in 1959. Net sales, however, totaled a record $40,155,108 compared with $40,013,633 registered in 1959.

Rohr Aircraft Corp. net earnings for the six months ended Jan. 31, 1961 were $2,225,729 on sales of $70,283,824. The same period a year ago showed a net of $1,757,011 on sales of $98,313,661.

McDonnell Aircraft had earnings of $5,950,381 on sales of $167,968,084 for the six months ended Dec. 31, 1960. Net earnings for the first half of Fiscal 1960 were $5,916,080 on sales of $217,513,144.

Hewlett-Packard Co. reported record sales of $60,206,918 in 1960. Earnings were also at a high of $4,226,645. These figures compare with 1959 sales of $47,745,073 and earnings of $3,899,941.

General Precision Equipment Corp. reports in preliminary figures that sales for 1960 were $244,000,000, up 13% from the 1959 figure of $215,588,430. Earnings for the year ended Dec. 31, 1960, were over $5,300,000 or $3.46 per share of common stock, compared with 1959 earnings of $4,198,200 or $2.63 per share.

Burroughs Corp. sales reached a new high in Fiscal 1960 of $389,210,550, compared with $359,778,068 in 1959. Net earnings for 1960 after taxes were $9,235,867 or $1.39 per share. The 1959 earnings were $7,109,567.

Chicago Aerial Industries had a loss of $717,861 for the year ended Dec. 31, compared with a net gain of 1959 of $724,354. Sales fell from the 1959 record of $12,368,061 to $6,196,460 this year.

The Siegler Corp.'s sales were $49,053,963 and earnings were $1,776,865 for the six months ended Dec. 31. Per share earnings in the first half of the company's fiscal year were $.80, based on 2,216,547 shares outstanding. Company figures include sales and earnings for the six-month period of Jack & Heintz, which was merged into the Siegler Corp. Feb. 2, 1961.

Republic Aviation Corp's sales for 1960 rose to $207,679,000 compared with sales of $198,065,976 in 1959. Earnings in 1960 were $4,652,000 or approximately $3.25 a common share on 1,431,448 shares outstanding. This is also a rise over 1959 earnings of $3,413,107 or $2.37 a common share on 1,437,148 shares outstanding.

Westinghouse Electric Corp. had a net income in 1960 of $79,057,000 or $2.22 a common share on sales of $1,910,730,000. Sales in 1959 were $1, 910,730,000 and income was $85,947,000 or $2.43 a share. In 1959, income of $7,196,000, equal to 21 cents a share came in the form of special non-recurring income from a federal tax refund.

Marc Shiowitz and Associates, Inc., a consulting firm specializing in the electronic computer field showed a profit after taxes of $23,690 on a gross income of $198,138 for the six months ended Dec. 31, 1960. Gross income for the six months ended Dec. 31, 1959 was $210,495 with profit after taxes of $21,860.

Hercules Powder Co. reported 1960 net sales and operating income of $336,905,000 compared with $283,650,000 for 1959. Net income of $27,165,000 for 1960 was equal to $3.05 a share of common stock after payment of dividends on preferred and Class A stock.

Packard-Bell Electronics Corp. had a $365,969 loss for the first three months ended Dec. 31. Deliveries for the first three months amounted to $8,738,350 compared with $13,305,018 for the same period last year. Military-industrial backlog, however, reached an all time high of $17,700,000 compared with $8,500,000 at the end of the first quarter a year ago.

International Rectifier Corp. reported sales of $6,941,832 for the second half of 1960, a gain of 8.5% over $6,396,201 for the same period in 1959.

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CHANCE VOUGHT AERONAUTICS

LETTERS

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Oriented Perceptron

Without in any way detracting from the usefulness and generally high quality of your avionics articles, I would like to correct an error in Mr. Klass' Artron discussion (AW Feb. 20, p. 52) and comment on a comparison which the article draws.

Contrary to the point made early in the article, the Mark I Perceptron is actually capable of identifying alpha-numeric characters irrespective of orientation. This capability has been proven both by simulation and experiment using the Mark I itself, although I recall it was not specifically demonstrated at the conference Mr. Klass attended here.

In another vein, when anyone draws a performance comparison between "today's reality" and "tomorrow's dream," the dream always seems to come out looking 10 ft. tall and twice as bright. Unfortunately, dreams seem to shrink and tarnish as they approach reality. Conversely, "today's realities" oftentimes represent the foundation for significant solid advancement into tomorrow. Thus it would be unwise to compare Mark I Perceptron with a concept as yet untested.

Although we are continuing our work on the Perceptron at Cornell, we have broadened and are expanding our interest in pattern recognition and artificial intelligence research. Naturally, the Artron concept will be one of the thoughts that will be considered in this broader research approach.

W. S. Holmes, Head
Cognitive Systems Group
Physics Division
Cornell Aeronautical
Laboratory, Inc.
Buffalo, N.Y.

(Although the Mark I Perceptron can learn to recognize alpha-numeric characters despite a slight amount of disorientation, a machine constructed from the more flexible Artron elements is expected to be able to tolerate disorientation up to the point of complete character inversion, according to Artron inventor Robert J. Lee. The comparison of the performance capabilities of the existing Perceptron and the projected Artron machine was not intended to reflect unfavorably on the former, but rather was intended to indicate the growing capabilities of future generations of self-learning machines.—Ed.)

Foreign Sailplanes

Your occasional articles on sailplanes are greatly appreciated and the one on the A-15 in the Feb. 20 issue (p. 99) was no exception. Such information, particularly regarding foreign sailplanes, is not readily available. Consequently, the information you publish is read with considerable interest by those interested in soaring.

The United States is fortunate to have some individuals who design and build high-performance sailplanes as private efforts. Three outstanding examples of these individuals are: Harland C. Ross, Richard E. Schreder and Leonard A. Niemi.

Mr. Ross is generally considered to be the father of the modern sailplane. These are designed for "Texas" thermals; that is, the sailplanes with high wing loadings (up to 9.8 lb./ft.^{2}) for operation under ideal conditions. He has designed and built six sailplanes in his spare time over the past 30 years. Most of these have been record-setting sailplanes in their day. Two of the most famous being the RJ-5, in which Dick Johnson set the existing world's record free distance of 535 mi., and the R-6, in which Mr. Ross in 1958 set three world's two-place records in three successive days and a U.S. national record on the fourth.

He is also a Diamond "C" pilot, making him rather unique in that he is a first-class designer, an expert craftsman, and a superior pilot.

Mr. Schreder, whose brochure on his tenth flying machine and fifth sailplane is enclosed, is the current U.S. national champion. He has established three single-place world speed records around triangular courses and an out and back world record flight of 338.5 mi. in his HP-8. The HP-10 features some interesting construction techniques.

We are looking forward to seeing this sailplane compete here in Wichita next August during the U.S. National Soaring Championships.

Mr. Niemi's SISU-I was flown in the 1960 National Championships and did quite well even though the pilot had little time with which to become familiar with the sailplane. Next year this sailplane will be flown by a more experienced pilot who will have had a full year's opportunity to become acquainted with this thoroughbred. Mr. Niemi has recently formed the Arlington Aircraft Co. and will build several SISU-IAs, an improved version of the original.

The SISU-I is characterized by superior design and its construction features meticulous attention to detail workmanship. Flight tests indicate it has one of the highest lift/drag ratios of any sailplane in the world.

It is indeed unfortunate there is no large public support that would permit the World's Soaring Championships to be held in this country in 1962. With proper support it would be possible for the U.S. to host this event and I think it would be extremely interesting to see the Soviets, among others, compete with their high-performance sailplanes, especially since theirs were designed and built by state-supported effort and employed some of their country's top engineering talent, and are flown by what might be considered professional glider pilots. On the other hand, the current U.S. crop of top sailplanes all represent the efforts of individuals whose prime efforts are necessarily devoted to other types of engineering and whose pilots are genuinely amateur.

I would like to recommend that in future issues you include some information on current designs by United States citizens. Perhaps these bits of information will prompt you to investigate and report on sailplane designs in this country. I'd also like to recommend you note the number of world records held by the U.S. as compared with the rest of the world. Significantly, this is strictly without the financial support of our government—a condition I sincerely hope continues.

Please continue with your occasional reports on gliding and soaring.

I would welcome the opportunity to supply additional information or completed articles regarding the above, or other U.S. sailplanes.

H. Marshall Claybourn
President
Kansas Soaring Assn.
Wichita, Kan.

Road-Tested Turbines

In your Feb. 27 description of the Currie Wot Rover-powered biplane (p. 88), you stated that Rover first tested a turbine-powered auto on "Mar. 9, 1959."

Perhaps it is unreasonable to rush to the typewriter to correct you, but you do Rover less than justice. Their first turbine-powered car ran in 1950, and was the first of its type in the world. It established some world speed figures on the Jabbeke road in Belgium, as I recall, at around 151 mph. They built a second around 1953-54, of which the details have slipped my mind, and a third in 1956. This last was an attractive blue coupe with fiberglass body, and used a 110-hp. (at 52,000 rpm.) turbine driving all four wheels. Fiat made a "Turbo-Fiat" in 1954, and Austin in 1955 put out a 125-hp. (23,000 rpm.) car. France's first was, I think, a 100-hp. Socema-Gregoire, then Renault built the "Etoile Filante" in 1956, using a Turbomeca turbine which has also seen service in aircraft. These are just a few of the international uses of gas turbines in cars.

The great significance of the gas turbine for road transportation in the future prompts me to drop you this note. Some of the problems are closely allied to those of using turbines for small business aircraft, so that you might derive some value from these infomal comments.

Thanks for Aviation Week. I find it regular, cover-to-cover pleasure every week.

John Joss
Mill Valley, Calif.

(To reader Joss and the others who wrote us on this error, our regrets for a printer's error. The date should be 1949, not 1959.—Ed.)